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WAGE DETERMINATION IN
CANADIAN MANUFACTURING INDUSTRIES

BY

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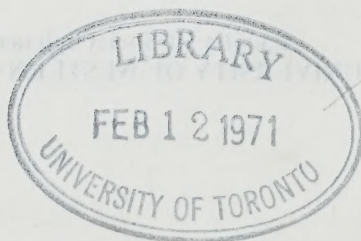
STUDIES
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CHAPTER I

WAGE DETERMINATION IN CANADIAN MANUFACTURING INDUSTRIES

INTRODUCTION

A central question that underlies much of the research on the determinants of wages is the extent to which the rate of change in wages is determined by the level of aggregate demand and competitive market responses and to what extent it is determined by other influences such as bargaining power, institutional practices, and special factors associated with particular industries. How one answers this question is obviously important from the standpoint of stabilization policy. If the rate of change in money wages is primarily determined by the level of aggregate demand, governments may wish to give more attention to regulating aggregate demand as a means of stabilizing the rate of increase in wages and prices than if the primary determinants of the rate of change in wages arise from supply and industry considerations. It is important to recognize from the outset, however, that even if one could demonstrate beyond all reasonable doubt that supply considerations and industry peculiarities were more important in some relevant sense in explaining changes in money wages than aggregate demand, it would not follow ipso facto that the best method of stabilizing the rate of change in wages and prices would be through supply or industry policies rather than through policies designed to regulate the aggregate level of

demand. Even though the source of instability may arise on the supply side of the market, it might conceivably be preferable to rely on demand policies for purposes of stabilization policy. The best remedy is not necessarily to attack the primary cause of rising wages and prices directly; other approaches also need to be considered. In sum, wages like other prices in the economy are determined by demand and supply. In order to devise an effective stabilization policy it is important not only to understand how these two blades of the Marshallian scissors interact to determine wages and prices but also to understand how effective the various instruments of economic policy are in modifying demand and supply conditions and what the implications of using these instruments are for the other goals of public policy. 1/

This study focuses on only one important sector of the first aspect of this issue, namely, the determinants of wages in Canadian manufacturing industry. Wage earners in this sector account for about 17 per cent of the employed labour force in Canada at present. No reference is made to the determinants of wages in other sectors of the economy nor to the determinants of salaries nor to the determinants of prices generally. And no attention whatever is given to the issue of designing an effective and an efficient stabilization policy.

The research undertaken for this study consists of two related parts. In the first part, the determinants of wages within major (two-digit) industrial classifications are examined. 2/ This portion of the analysis attempts to bring together two lines of economic research that have developed more or less independently of each other in recent years. 3/ One of these lines of research has been concerned with assessing the determinants of wages at a highly aggregative level. Much of it has consisted of attempts

to extend and apply "Phillips-curve" analysis or to provide an alternative
to "Phillips-curve" analysis. The second line of inquiry has been concerned
with the short-run relationship between variations in output and employment
in manufacturing.

In the second part of the analysis attention focuses directly on the
role of "key" industries and "key" bargains in the determination of wages
in Canada. Interest in this question reflects the importance that has been
attributed to key industries and bargains as determinants of wages in other
countries, especially in the United States and the United Kingdom, by a
number of investigators. Moreover, previous research in Canada has suggested
the interesting possibility that in so far as key bargains play a role in
determining wages in Canada the key bargains may be those struck in the
United States rather than those struck domestically. Investigation of this
hypothesis for Canada remains very difficult at present because of a lack
of satisfactory statistical data, even though the information available in
this area has recently been considerably enhanced by the development in the
Department of Labour of new data on wage agreements in Canada.

In the discussion that follows, Chapters II to III are concerned with
the first part of this investigation and Chapter IV with the second. In
Chapter II the relevant literature is briefly reviewed and a theoretical
model is developed as a basis for the empirical work undertaken for the
first part of this study. In Chapter III, the empirical analysis based on
this model is presented and analysed. Chapter IV is concerned with the
question of key industries and key bargains. Chapter V presents a brief
summary of the analysis and a résumé of the main conclusions.

Ideally the questions raised in this study should be investigated with the aid of a well-developed, detailed model of the Canadian labour market— if not of the whole economy. It has been clear from the outset that within the constraints imposed by time, resources and available statistical data, it was hopeless to think in terms of developing and testing out such a full-scale model. Instead a more limited approach has been adopted; and even with this more limited approach it has not been possible to explore as widely and as deeply as might have been warranted. In these respects at least, this study bears some of the earmarks typically associated with studies done for Royal Commissions and the like.

REFERENCES

1/ For an excellent analytical review of the phenomenon of price inflation
    including a brief discussion on the determinants of wages, see R.J. Ball,
    Inflation and the Theory of Money (Chicago: Aldine Publishing Co., 1964)
    especially Chapter VII.

2/ Standard Industrial Classification system.

3/ A similar approach has been developed independently by Gérald Marion
    for estimating the aggregative wage change relationship in "La Demande
    excédentaire de travail et la variation des salaires dans l'industrie
    manufacturière au Canada", The Canadian Journal of Economics I (Aug.
    1968) 519-539. Timothy W. McGuire and Leonard A. Rapping in a highly
    disaggregative analysis based on annual United States data follow an
    approach that is also similar in some respects. "The Role of Market
    Variables and Key Bargains in the Manufacturing Wage Determination
    Process", The Journal of Political Economy 76 (Sept./Oct. 1968) 1015-36.

CHAPTER II

THEORETICAL CONSIDERATIONS

As already noted the theoretical model that is developed in this study to try to explain empirically the rate of change in wages in particular manufacturing industries has been largely inspired by recent research on two related issues: the wage-adjustment relationship for the economy as a whole; and short-run employment functions in manufacturing industries. Recent research on each of these issues will be briefly summarized before presenting the model on which the first part of this study is based.

1.   The Wage-Adjustment Relationship

The view that the rate of change in wages for the economy as a whole is influenced by the level of unemployment goes back at least to the time of Keynes' General Theory. However, most of the theoretical and empirical work on the wage-adjustment relationship has followed in the wake of a seminal paper published by A.W. Phillips in 1958 and elaborated upon by R.G. Lipsey in a paper published two years later. 1/ The central notion underlying this work is the familiar idea that prices rise in response to excess demand and fall in response to excess supply. As applied to the labour market, the hypothesis is that the rate of change in money wages is

related to the level of unemployment, which is assumed to reflect the degree
of excess demand or excess supply in the labour market. In subsequent work,
the relationship has been expanded to allow for other factors influencing
the rate of change in wages in addition to the level of unemployment. 2/
Among these other factors have been changes in the level of unemployment
rates, the level of profits or the rate of change in profits, the level of
productivity or the rate of change in productivity and the influence of wage
changes realized in the past.

Recent empirical work based on Canadian data suggests that some 85
per cent of the quarterly variation in the rate of change in all manufac-
turing wages from 1953 to 1965 can be explained in terms of the following
five factors: i) variations in the rate of change in consumer prices,
ii) variations in the level of unemployment, iii) variations in the level
of profit per unit of output, iv) variations in the rate of change in manu-
facturing wages in the United States and v) a lag term, reflecting the
influence of earlier variations in wages on the current rate of change in
wages. In formal terms, the empirical wage adjustment relationship that
has been derived is as follows: 3/

(II.1)

$$\dot{W}_t = -4.32 + 0.487\dot{P}_t^* + 18.4U_t^*{-2} + 0.0618(Z/Q)^*_{t-2} + 0.291\dot{W}_{us_t}^* - 0.116\dot{W}_{t-4}$$

$$[6.42] \quad [2.96] \quad\quad [3.16] \quad\quad\quad [2.51] \quad\quad [3.02]$$

$$R^2 = 0.847$$
$$\text{D. W.} = 1.62$$

where

$\dot{W}_t = \dfrac{W_t - W_{t-4}}{W_{t-4}} \cdot 100$ percentage change in average hourly earnings of
production workers in manufacturing between a
given quarter and the corresponding quarter one
year earlier. (Dominion Bureau of Statistics).

$$\dot{W}^*_{us_t} = \frac{1}{4} \sum_{j=0}^{3} \dot{W}_{us_{t-j}} \qquad \text{where} \qquad \dot{W}_{us_t} = \frac{W_{us_t} - W_{us_{t-4}}}{W_{us_{t-4}}} \cdot 100 \quad \text{and} \quad W_{us}$$

is average hourly earnings in United States manufacturing in United States dollars (United States Department of Labour).

$$\dot{P}^*_t = \frac{1}{4} \sum_{j=0}^{3} \dot{P}_{t-j} \qquad \text{where} \qquad \dot{P}_t = \frac{P_t - P_{t-4}}{P_{t-4}} \cdot 100 \quad \text{and} \quad P \text{ is the}$$

consumer price index (Dominion Bureau of Statistics).

$$(U^*_t)^{-2} = \text{reciprocal of } (U^*_t)^2 \qquad \text{where } U^*_t = \frac{1}{8} U_t + \frac{1}{4} \sum_{j=1}^{3} U_{t-j} + \frac{1}{8} U_{t-4}$$

and U_t is unemployment rate in the tth quarter. (Dominion Bureau of Statistics).

$$(Z/Q)^*_t = \frac{1}{4} \sum_{j=0}^{3} (Z/Q)_{t-j} \cdot 100 \qquad = \text{four-quarter moving average of the profit}$$

mark-up on output (i.e., profits per unit of output in manufacturing) as an index (1949 = 100). Z_t = Corporate profits in manufacturing before tax. (Dominion Bureau of Statistics); and Q_t = revised index of manufacturing production (Dominion Bureau of Statistics).

R^2 = Coefficient of multiple determination

D.W. = Durbin-Watson statistic

t-ratios are shown in square brackets.

It is important to recognize that this relationship attempts to explain the rate of change in wages in manufacturing as a whole. The rationale for including the unemployment rate has already been referred to. Inclusion of the consumer price index reflects the idea that wage earners are aware to

some extent at least of the influence of rising prices on the real wage rate and that they use whatever bargaining power they may have to try to restore and maintain the real wage rate in the face of rising prices. The role ascribed to unit profits is based on the view that the higher the level of corporate profits the more likely it is that labour will try to appropriate some of this profit in the form of higher wages and the easier it will be for managements to accede to labour's demands; and vice versa. As for the influence of United States wages, one can argue that trade union policies in Canada are influenced by United States union policies through two channels: first, many Canadian unions are affiliated with United States unions; and whether affiliated or not, Canadian labour has frequently expressed its wage demands in relation to the level of United States wages, either demanding full parity or a narrowing of the gap between United States and Canadian wages. Secondly, one might expect wage changes in many United States industries to have spillover effects on Canadian wages in much the same way that wage changes in certain key industries within the United States are thought by some researchers to have spillover effects on wages in other sectors of the United States economy. 4/ In other words, for Canada the key group of industries setting the pace which wage demands in this country tend to emulate may be found in the United States rather than domestically. Finally, the inclusion of a lag term in equation (II.1) is based on the straight-forward idea that current wage demands are likely to be conditioned by the change in wages realized in the immediate past.

In the tests made by Bodkin et al. on Canadian data no evidence was found to suggest that the rate of change in wages is significantly influenced by the level of productivity or by the rate of change in productivity. In a recent paper, E. Kuh suggests that profits serve as a proxy for productivity in the wage-adjustment relation and that productivity is "a more

fundamental determinant of wages than profits". 5/ Empirical analysis based on United States experience from 1950 to 1960 is presented to support his hypothesis. However, as Kuh himself says, the evidence in favour of productivity over profits for inclusion in the wage adjustment relationship is "not clearly decisive" at present, implying that more research is required to illuminate this matter.

2. Short-Run Employment Functions

Although there has been active interest in and research on the question of the relationship between short-run variations in output and employment for many years, particular attention has been given to this question in a number of empirical studies that have been published during the past five years. For our purpose we shall focus mainly on the papers by F. Brechling and P. O'Brien and by R.J. Ball and E.B.A. St. Cyr. 6/ Essentially these studies explain short-term variations in employment as a function of output, a lag in the adjustment of actual employment to desired employment and a time trend to take account of secular factors influencing employment, such as the growth in the capital stock.

The theoretical basis for this relationship is outlined in the papers cited. Some of its leading features may be briefly summarized as follows: 7/

a) The observed level of employment in manufacturing is assumed to be demand determined—supply constraints are assumed to be absent or negligible.

b) The typical entrepreneur regards his output, capital stock, and techniques of production as given in the short run. Consequently, in the short run, the entrepreneur's desire for labour services may be described

as a function of output, Q, the size of the capital stock, K, and techniques
of production, T:

(II.2) $E^* = f\ (Q,\ K,\ T)$

E^* can be expected to be positively associated with Q and negatively asso-
ciated with K and T.

c) Labour services have two dimensions: the number of men employed,
M, and the average hours worked, H. Hence

(II.3) $E^* = MH^*$.

d) It is assumed that the appropriate functional form of equation is
log-linear. Further, owing to the lack of appropriate data for K and T it
is assumed that changes in K and T can be approximated by a time trend, t.
Hence

(II.4) $\log E^*_t = B_0 + B_1 \log Q_t + B_2\ t$

e) Entrepreneurs are assumed to adjust the desired level of employment
with a lag. There are two reasons for assuming such a lag: first changes
in employment have costs that are positively related to the speed of adjust-
ment; secondly, because of uncertainty about the future, entrepreneurs may
not adjust fully to current changes in E^*. A convenient lag structure is
the well-known stock-adjustment process according to which:

(II.5) $\log E_t - \log E_{t-1} = (1 - a_3)\ (\log E^*_t - \log E_{t-1})$

which may be written

(II.6) $\log E_t = (1 - a_3)\ \log E^*_t + a_3\ \log E_{t-1}$

where $(1 - a_3)$ is the proportion of the logarithmic difference between
actual and desired employment that is eliminated in the current period.

f) Equations (II.4) and (II.6) may be combined and dummy variables added to allow for seasonality to give the following relationship:

$$\text{(II.7)} \quad \log E_t = a_0 + a_1 \log Q_t + a_2 t + a_3 \log E_{t-1}$$
$$+ a_4 D_2 + a_5 D_3 + a_6 D_4 .$$

This equation is consistent with cost minimization for the entrepreneur, assuming a Cobb-Douglas production function and a plausible labour cost function. 8/

g) The effect on employment of entrepreneur's expectations about future levels of output is recognized in this formulation to the extent that entrepreneur's expectations and their response to these expectations are based on past experience.

h) From equation (II.7) one can derive the desired level of employment in every quarter by assuming that sufficient time has elapsed for the lag of adjustment between actual and desired employment to exhaust itself. In other words, one can assume that $\log E_t = \log E_{t-1} = \log E^*$ where E^* indicates the equilibrium value of E. From (II.7) one can say that the B's in equation (II.4) are equal to $\dfrac{a_i}{1 - a_3}$.

The relationship estimated on the basis of quarterly data from 1950 to 1964 by Brechling and O'Brien for all Canadian manufacturing is as follows:

$$\text{(II.8)} \quad \log E_t = 0.1217 + 0.4746 \log Q_t - 0.001513\ t + 0.4904 \log E_{t-1}$$
$$(0.0826) \qquad (0.00028) \qquad (0.0930)$$
$$+ 0.0016\ D_2 + 0.0089\ D_3 - 0.0113\ D_4$$
$$(0.0030) \qquad (0.0023) \qquad (0.0024) \qquad \bar{R}^2 = .89$$
$$\text{D.W.} = 1.69$$

where E_t = number of men employed in manufacturing

Q_t = output in manufacturing

t = time, numbering quarters consecutively from 1 to 50 beginning with the second quarter, 1950

D_j = seasonal dummies

log = logarithm to the base 10

$\bar{R}^2$ = coefficient of multiple determination, adjusted for degrees of freedom

D.W.= Durbin-Watson statistic

Figures in parenthesis are standard errors.

According to this relationship about 90 per cent of the variation in the proportional change in employment can be explained by changes in the proportional change in output, a secular trend, an adjustment lag and seasonal variations.

If we proceed in the manner already outlined, the equilibrium form of equation (II.8) is given by equation (II.9).

$$(II.9) \quad \log E^* = 0.2388 + 0.9313 \log Q_t - 0.002969 \, t + 0.0031 \, D_2 + 0.0175 \, D_3$$
$$- 0.0222 \, D_4$$

In this form equation (II.9) provides an empirical estimate of the equilibrium (steady-state) level of employment for every quarter in the sample period. When the actual level of employment is less than the equilibrium level, the difference represents vacancies that employers can be expected to try to fill over time as they adjust the level of employment to the level of output. When the actual level of employment is greater than the equilibrium level, the difference represents redundant labour that employers can be expected to release from employment over time as they adjust

the level of employment to the level of output. The lag structure implied
by equation (II.9) suggests that virtually all of the adjustment will have
been completed within one year of the initial change in output giving rise
to the adjustment process. About half of the adjustment in employment in
all manufacturing will have occurred at the end of the first quarter after
the initial change in output, about three-quarters at the end of the second
quarter, and about 90 per cent at the end of the third quarter.

5. A Model for Evaluating the Determinants of Wages in Manufacturing Industries

A principal purpose of this study has been to examine the determinants
of wages in manufacturing at a greater level of detail than is possible on
the basis of a wage-adjustment relationship for the economy as a whole or for
the whole manufacturing sector, such as the relationship described earlier
was designed to do. It is apparent that it is not very satisfactory to try
to fit the same relationship that was fitted for the aggregative relationship
to explain wage changes in particular industries. For example, it is evident
that wages in one industry are likely to be influenced by wages in other
industries. In addition, it is not clear that much meaning can be attached
to the concept of unemployment in particular industries since there is likely
to be considerable mobility of labour between industries, particularly among
less skilled labourers who comprise the largest proportion of the unemployed.
Further, it is evident that both the level and the rate of change in wages
in a particular industry are likely to be influenced by the level of output
and changes in output in that particular industry. Also wages and wage
changes in a particular industry may be influenced by trade union activities
in that industry.

In developing a model for analysing wage levels and changes in wage levels it was deemed important that the framework explicitly recognize these and other considerations affecting wages on both the demand and the supply side of the labour market. It was also considered essential that the model be developed in an operational form, in the sense that data could be found to apply the model and that the applications could be made without exceeding the time and resources available for this study. Finally, it was thought desirable that the model be developed in a form that could be readily related to the aggregative wage-adjustment relationship that has been estimated for Canada. This consideration influenced the form of some of the relationships that were developed and the form in which variables were included in these relationships.

In effect, a model has been developed that explains the rate of change in wages in relation to the excess demand for labour,—i.e., the difference between the quantity demanded and supplied. This model is estimated by a two-stage procedure. In stage one an estimate is made of industry i's demand function for labour. In stage two this is combined with the supply function of labour confronting industry i to estimate the determinants of the rate of change in wages in industry i.

Each of these stages will be discussed in turn in the remainder of this section and in section 4 a summary of the full model is presented.

a) Industry Demand for Labour

Following Brechling and O'Brien and Ball and St. Cyr in the papers already cited, short-run employment functions of the following form may be fitted to any particular industry, i:

(II.10)

$$\ln MH_{i_t} = \alpha_1 \ln Q_{i_t} + \alpha_2 t + \alpha_3 \ln MH_{i_{t-1}} + \alpha_4 D_1 + \alpha_5 D_2 + \alpha_6 D_3 + \alpha_7 D_4$$

or

(II.11)

$$MH_{i_t} = \alpha'_1 Q_{i_t} + \alpha'_2 t + \alpha'_3 MH_{i_{t-1}} + \alpha'_4 D_1 + \alpha'_5 D_2 + \alpha'_6 D_3 + \alpha'_7 D_4$$

where MH_i = man-hours employed in the ith industry.

Q_i = output in the ith industry.

t = time

D = seasonal dummy variables, one for each quarter.

α_j and α'_j = parameters to be estimated.

ln = logarithm to the base e.

This relationship assumes that short-run variations in the number of man-hours employed in a particular industry can be largely explained in terms of variations in output, a secular trend, a lag in the adjustment of actual employment to desired employment and seasonal variations. In their work, Ball and St. Cyr and, in their recent paper, Brechling and O'Brien assume a log-linear relationship such as shown in equation (II.10). Equation (II.11) assumes a simple linear relationship. Both equations have built-in adjustment factors. In his earlier analysis Brechling presents estimates employing both a simple linear form and a log-linear form. The linear regressions provided a somewhat better statistical fit judged by the value of R^2 and are used in his text; 9/ the estimates based on the log-linear form that are presented in the Appendix are quite similar however. In principle, there is no a priori reason for preferring one form over the other.

Which form one chooses to employ is largely a matter of which form provides the better statistical fit. Both forms have been used in the present study depending upon which provides the better fit.

Having derived either of these relationships, an estimate of the equilibrium level of employment in terms of man-hours, MH^*, can be calculated for every observation by setting MH_{i_t} equal to $MH_{i_{t-1}}$. The resulting estimate for equation (II.11), for example, is as follows:

(II.12)

$$MH^*_{i_t} = \alpha'_1 \frac{}{1-\alpha'_3} Q_{i_t} + \alpha'_2 \frac{}{1-\alpha'_3} t + \alpha'_4 \frac{D_1}{1-\alpha'_3} + \alpha'_5 \frac{D_2}{1-\alpha'_3} + \alpha'_6 \frac{D_3}{1-\alpha'_3} + \alpha'_7 \frac{D_4}{1-\alpha'_3}$$

If now we subtract estimated equilibrium employment in the industry for a particular time period $MH^*_{i_t}$, from actual employment for that time period, MH'_{i_t} , we can derive an estimate of job vacancies or redundancies in that particular industry. If we designate vacancies or redundancies as e , then

(II.13) $e_{i_t} = MH'_{i_t} - MH^*_{i_t}$.

(II.14) $e_1 = $ e when e is negative and is equal to zero otherwise.

(II.15) $e_2 = $ e when e is positive and is equal to zero otherwise.

The estimates of e_1 may be regarded as estimates of vacancy statistics for the industry in question (expressed in man-hours) and the estimates of e_2 may be regarded as estimates of the amount of redundant labour in the industry (expressed in man-hours) at any given time.

It is important to note that throughout this analysis the demand for labour is expressed in terms of man-hours. When output changes, employers may adjust either the number of employees or the number of hours. No

distinction is made between these two possibilities in equations (II.10) and (II.11) which focus only on the total volume of labour inputs. Because of this, the employment functions presented in this study differ somewhat from those published by Brechling and O'Brien and by Ball and St. Cyr who use the number of men employed as the dependent variable in their empirical estimates. The reason for employing man-hours rather than the number of employees is because it is the determinants of the price of man-hours—wages, expressed in terms of average hourly earnings—which the present study seeks to identify and evaluate.

The formulation outlined above assumes that the actual and equilibrium input of labour differ for two reasons. The first is because of a variety of random external factors that preclude employers from attaining the equilibrium level of labour inputs. These are represented by the residual error terms which are not shown in equations (II.10) and (II.11) . The second reason is the lag in the reaction of employers to changes in output as reflected in the adjustment lag included in these equations. There is considerable evidence, in addition to that provided by Brechling - O'Brien and Ball—St. Cyr, that as output expands employers take some time to increase employment to the level required to sustain output at the higher level; similarly, when output falls employers take some time to reduce employment to the level consistent with the lower level of output. This is one reason, it is widely believed, why labour productivity tends to move inversely with changes in output over a portion of the short-term business cycle. 10/

An alternative to the foregoing approach to estimating vacancies and redundancies (in terms of man-hours) is, of course, to survey industries to obtain direct estimates of the figures in question. Unfortunately no such data are available for Canada at present.

In this study it is assumed that the demand for labour in any period in any particular industry is given by equations (II.10) and (II.11). These formulations differ from the usual demand relationship in that prices (wages) are not included as a determinant of demand. In effect, they are inverted production functions. The inclusion of a time trend in the relationship allows for secular changes to occur overtime in the technical coefficients of production in response to technical changes and secular changes in the relative supplies of factor inputs. And the inclusion of an adjustment factor allows for deviation from the implied equilibrium labour-output ratio in the short term. 11/
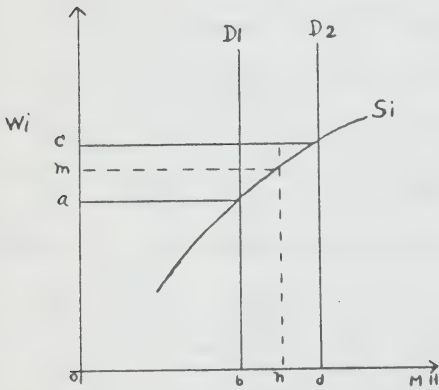
Figure I

The influence of the adjustment factor on wage changes may be illustrated with the aid of Figure I which assumes a given supply relationship, S_i, as a function of wages paid in industry, i, W_i. D_1 is the demand for labour in period one which is assumed to be equal to the supply, o b, at the wage o a. Demand is completely inelastic with respect to W_i in accordance with the production functions assumed in equations (II.10) and (II.11). Suppose demand increases to D_2. At the new equilibrium entrepreneurs will wish to hire o d of labour for which they will have to pay o c . However, within the first quarter after the change in demand they manage, for a variety of reasons, to hire only b n of additional labour. Hence, at the end of the quarter they have n d vacancies (in terms of man-hour inputs) remaining to be filled. In employing b d

of additional labour, employers presumably can move the wage up slowly and
gradually approach the new equilibrium wage rate which will eliminate their
vacancies. At the end of the quarter the wage might have reached o m in
its progress to the equilibrium wage o c . On this assumption one might
expect the demand for labour, $\widehat{MH}_i$, as estimated from equation (II.10) or
(II.11), to be significantly related to the change in wages. 12/ Altern-
atively, employers, recognizing from the outset how much additional labour
they require to regain their optimum labour-output ratio, may immediately
set the wage at roughly o c in order to fill their vacancies as rapidly
as possible. In this case one would expect MH* to be a "better" variable
to explain changes in wages than $\widehat{MH}$. By considering both MH^* and $\widehat{MH}$ as
possible determinants of wage changes, one can hope to learn something about
how employers adjust wages in response to a change in output.

Both MH^* and $\widehat{MH}$ may be regarded as representing the "desired" level
of labour inputs from the standpoint of the entrepreneurs. MH^* represents
the amount of labour they eventually wish to have (within a year roughly,
judging from the Brechling-O'Brien estimate) if the other variables entering
their production function remain unchanged. $\widehat{MH}$, on the other hand, repre-
sents the amount of labour they wish to have at the end of the current quar-
ter following a change in output. Presumably by incurring enough expense
and raising wages sufficiently, entrepreneurs could move to the new equilib-
rium position within the current quarter. This strategy might be very
costly, however. In addition to incurring substantially greater direct
costs for recruitment, wages might have to be raised considerably more than
if the new target is approached more gradually—and this "extra" increase
in wages would have to be paid not only to new employees but also to all
existing employees. Similarly, in situations where reductions in employment

are called for, implementing these reductions over two or three quarters may be less disruptive and costly than implementing them abruptly.   Moreover, considerable uncertainty is necessarily associated with a change in output in any given quarter. By reacting gradually over two or three quarters rather than instantaneously, entrepreneurs can in part at least avoid much unnecessary adjustment to random disturbances while at the same time ensuring that they are adjusting to more permanent changes in output. 13/ For these reasons it seems likely that $\widehat{MH}$ represents the demand for labour in any given quarter more adequately than MH^{*}—a presumption that our empirical tests have borne out.

Finally, there is the question of what influence vacancies and redundancies (expressed in terms of man-hours) may have on wage changes—e , as derived from equation (II.1$\mathfrak{z}$). The importance of allowing for vacancies and redundancies in estimating aggregative wage-adjustment relationships has been emphasized by several economists in recent years. 14/ Within the framework of "Phillips-curve" analysis, the argument essentially is that the influence of unemployment on the rate of change in wages at any given time will be conditioned by the number of vacancies and redundancies in existence at the time. From the standpoint of the demand for labour in a particular industry as elaborated above, it is doubtful whether vacancies and redundancies have any significant influence on wages. As already noted, vacancies and redundancies in any quarter may be thought of as comprising two components—a random error term or transient element and that portion of the lagged adjustment in employment remaining to be completed at the end of the current quarter following a change in the equilibrium level of employment. Algebraically, from equations (II.11) and (II.13)

$$MH'_i = \hat{MH}_i + u_i$$

$$MH^*_i = \hat{MH}_i - \alpha'_3 MH'_{i-1} + \alpha'_3 MH^*_i ; \underline{15/}$$

$$e_i = MH'_i - MH^*_i = u_i + \alpha'_3 (MH'_{i-1} - MH^*_i)$$

where MH'_i is actual employment in industry i, u is a randomly-distributed residual error term and α'_3 is the parameter of the lagged value of MH'. During the current quarter, $(1 - \alpha'_3)$ of the lagged adjustment is realized leaving α'_3 of the adjustment to be realized in future quarters. It is not clear why one would expect the randomly distributed disturbance component of vacancies and redundancies to influence wages. Indeed, if employers could isolate this element in their vacancies and redundancies it is likely that they would actively seek to avoid adjusting their wages in response to such disturbances on the ground that over time these transient elements will cancel each other out. The lag component of vacancies and redundancies, on the other hand, is reflected in $\hat{MH}$. In terms of Figure I, it is reflected in how far along the supply curve S_i employers have opted to move at the beginning of the quarter. Hence, once the demand for labour in any quarter has been taken into account—$\hat{MH}_i$ in our formulation—it seems likely that little scope remains for vacancies and redundancies—e_i in our notation—to influence wages independently. The same is true if, instead of approaching their new equilibrium wage gradually, employers move to their new equilibrium position without a lag. This view of the influence of vacancies and redun- dancies, it should be recognized, applies regardless of whether the empirical estimates of e are derived directly from a survey of employers or indirectly from the procedure outlined above. 16/ The a priori presumption that vac- ancies and redundancies have no significant influence on wages once the

demand for labour has been adequately allowed for is borne out by the empirical tests undertaken for this study.

b) Industry Supply of Labour

We assume that the supply of labour available to any particular industry, i , is determined by the relative wage paid in industry i compared to the wage paid in all manufacturing, the relative wage paid in industry i compared to the wage paid in the corresponding industry in the United States, the level of unemployment in the manufacturing sector of the economy and the level of profits in industry i. In formal terms,

$$(\text{II.16}) \quad S_i = \beta_0 + \beta_1 \, W_i/W_T + \beta_2 \, U^{-2} + \beta_3 \, W_i/W_{us_i} + \beta_4 \, \pi_{i_{-2}}$$

where S_i = number of man-hours supplied to industry i at time t

W_i = average hourly earnings in industry i

W_{us_i} = average hourly earnings in industry i in the United States

W_T = average hourly earnings in all manufacturing industries

U^{-2} = reciprocal of the square of the percentage of the labour force in the manufacturing sector that is unemployed

$\pi_{i_{-2}}$ = profits per unit of output in the ith industry, lagged two quarters

β_j = parameters to be estimated.

The rationale for including the relative wage W_i/W_T, rests on the straightforward proposition that the amount of labour supplied to an industry depends on the wage paid in that industry relative to wages paid in manufacturing generally. As W_i rises relative to W_T , the supply of labour can be expected to increase, and vice versa. This relationship is illustrated in Figure II. Given the level of demand D_i and a **wage** rate in all
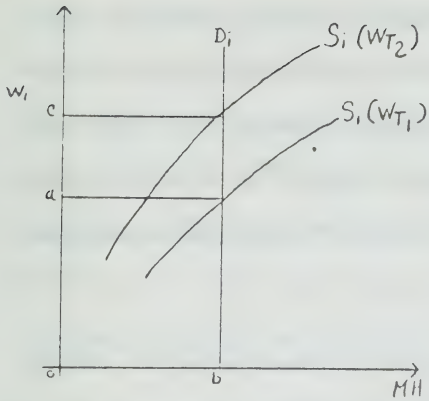
Figure II

manufacturing of W_{T_1}, the equilibrium wage rate is o a. An increase in the average wage rate in all manufacturing to W_{T_2} shifts the supply schedule to the left. In order to maintain the same level of employment, o b, employers in industry i must raise the wage rate to o c.

In addition to the influence of relative wages, the level of unemployment in the economy generally can be expected to influence the supply of labour offered to any industry at any given relative wage rate. With substantial unemployment in the economy (or at least in the manufacturing sector), little or no increase in the relative wage may be required to hire more labour. 17/ At low levels of unemployment on the other hand, it is plausible to assume that comparatively larger relative wage increases will have to be offered to increase employment in a particular industry. By including the unemployment variable in the relationship in the form of the reciprocal of the square of the percentage level of unemployment, one allows for the changing importance of unemployment on the supply of labour as the percentage level of unemployment changes. The use of the square of unemployment implies an unemployment-labour supply curve that is steeper in the low ranges of unemployment and flatter in the higher ranges of unemployment than would be the straight reciprocal. Another way of looking at the inclusion of U^{-2} is that it serves as a shift variable that moves the supply schedule in and out in response to changing levels of unemployment. The non-linear form of the variable implies that for any given unit change in unemployment the schedule shifts further at low levels of unemployment than at high levels

of unemployment. The rationale for this assumption is the same as the rationale for using the variable in reciprocal form in fitting the aggregative wage-adjustment relations discussed earlier. Research that has been done on these aggregative relationships suggest that U^{-2} is a more appropriate form of the unemployment variable than either U^{-1} or U , when employed to explain wage changes. 18/

This relationship is illustrated in Figure III where again we assume demand, D_i, is given and also that W_T is given at $\overline{W}_T$. It is assumed that $U_1 > U_2 > U_3$ and $U_2 - U_1 = U_3 - U_2$. As unemployment decreases from U_1 to U_3 it is necessary to pay higher wages in industry i in order to keep employment at o b . Moreover, given a decrease in unemployment from U_2 to U_3 it is assumed that a higher increase in wages is required to keep the same amount of labour in the industry than if unemployment decreases from U_1 to U_2 - i. e. > a b > a c.

In a purely competitive labour market, one might be prepared to assume that the labour supplied to a particular industry is largely to be explained by differences in the rate of change in wages in different industries and the level of unemployment.
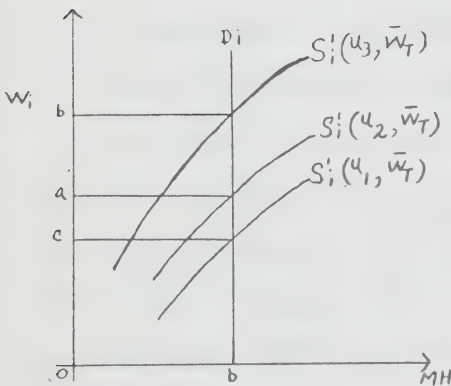
Figure III

The existence of collective bargaining on a wide scale in Canadian manufacturing makes it questionable, however, whether such a simple model is adequate. To the extent that trade unions influence wages, they do it by exercising monopoly power, the essence of which is control over the supply of labour. How much trade unions affect wages in particular industries and

in the economy as a whole remains an open question on which an extensive literature has developed. Neither this question nor the literature that it has evoked will be reviewed here. It is apparent, however, that in order to be plausible the labour supply function for a particular industry must allow for at least the possibility of the supply of labour being influenced by union activity. What is less apparent is how this factor can best be incorporated into the analysis.

There seem to be no variables at hand that can be included in the labour supply function to reflect directly the influence of union power on the supply of labour. Instead, it is necessary to rely upon proxy variables to reflect the influence of union power indirectly. Failing a direct measure of union influence, the next best thing appears to be to look at those factors in relation to which unions exercise whatever influence they may have on the supply of labour. One of these factors, one might assume, is the general economic environment governing the rate of increase in wages generally. According to the wage adjustment relationships estimated for the manufacturing sector as a whole, the main factors in the general economic environment having an important influence are the rate of increase in prices, the level of unemployment, the level of profits, the rate of increase in United States wages and the size of earlier wage settlements—the factors discussed at the beginning of this chapter. The influence of the general environment is reflected in the supply relationship by $\dot{W}_T$. It is also reflected in the unemployment variable U^{-2}. Nevertheless, union strength may well be relatively weaker when unemployment is high than when it is low. Although $\dot{W}_T$ is partially explained by U^{-2}, it is conceivable that the general level of unemployment may have an independent effect on particular industries in addition to its general effect via its influence on $\dot{W}_T$.

Aside from these variables, the arguments that unions advance in the course of negotiations suggest that any control they have over the supply of labour may also be influenced to an important degree by the level of profits in the industry and by the relationship between wages in the same industry in Canada and in the United States. Consequently, π_i and W_i/W_{us_i} have been included in the supply function. The emphasis given by unions to the level of profits in negotiating for higher wages is common knowledge and need not be elaborated upon. This mechanism would not be expected to function in a purely competitive labour market. In our quarterly estimates π_i has been included in the supply relationship with a two quarter lag. The reason for including a lag is that it is plausible to expect some lag between the time when profits are earned and the time when information about these profits becomes available to both management and trade unions and both have an opportunity to react to this information. The existence of an information-reaction lag is supported by the experiments undertaken in the process of fitting an aggregative wage adjustment relationship. These experiments indicated the likelihood that the level of profits affects the rate of change in wages with a lag of approximately two quarters. 19/

The role of W_i/W_{us_i} is less obvious and calls for somewhat more extended discussion. There are several ways in which wages in the same industry in the United States may influence wages in Canadian industries. First, as noted earlier, many Canadian trade unions are affiliated with United States unions. Consequently, they may be influenced not only by the same general policies that are pursued in corresponding United States industries but also by much the same information and bargaining expertise. Moreover, since the majority of union members are resident in the United States and the international headquarters of the unions are in the United States,

one can assume that these policies together with the supporting information
and expertise are largely geared to United States conditions with some scope
remaining for adaptation to Canadian circumstances. Secondly, whether affil-
iated or not with United States unions, many Canadian unions evidently look
to United States wages and wage changes as a guide in framing their own
demands. 20/ The most obvious case of this is the emphasis that has been
given to "wage parity" in recent years in Canada, particularly in the automo-
bile industry. 21/ The importance of these two channels of influence may
be expected to differ considerably from industry to industry.

Apart from the influence which W_i/W_{us_i} may have on the supply of labour
via its effect on the way unions exercise whatever control they may have
over the supply of labour, W_i/W_{us_i} may also be included as a determinant
of the supply of labour on the ground that the supply of labour in an indus-
try may respond to relative wages in the same industry in Canada and in the
United States. This is likely to be more important among the more mobile
sectors of the labour force—for example, skilled labourers such as engineers
and labourers living in close proximity to firms in the same industry in
the United States, such as the auto workers living in Windsor. In these
cases a more rapid increase in United States than in Canadian wages might be
expected to result in an emigration of labour and a reduction in the supply
of labour available to the Canadian industry; and vice versa.

The influence of W_{us_i} and $\pi_{i_{-2}}$ is illustrated in Figures IV and V
which assume that Di is given as before, and that U and W_T remain
unchanged at $\overline{U}$ and $\overline{W}_T$. In Figure IV when W_{us_i} increases from W'_{us_i}
to W''_{us_i} , it is necessary to increase W_i from o a to o c to keep
employment in the industry at o b. And in Figure V which assumes that
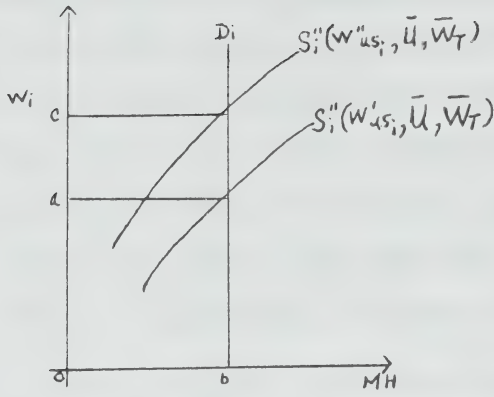
Figure IV
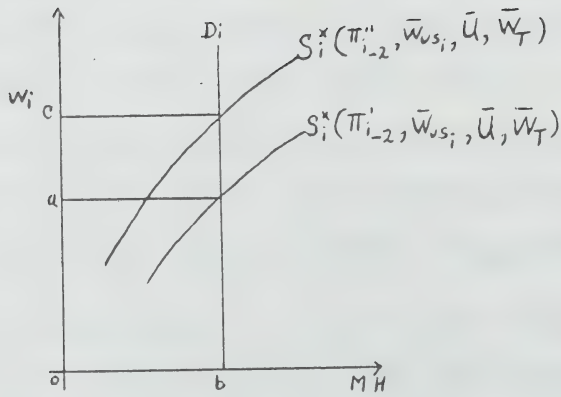
Figure V

W_{us_i} remains unchanged at $\overline{W}_{us_i}$, it is also necessary to increase wages from o a to o c in order to maintain employment at o b when profits increase from π'_i to π''_i with a two quarter lag.

4. A Summary of the Model

The model that has been developed to analyse the determinants of wages in Canadian manufacturing industries may now be summarized as follows. Applying Walras' dynamic assumption, one may assume that the rate of change in wages per unit of time, $\frac{dW}{dt}$, in any industry, i , is a function of the level of excess demand, XD , which is defined as the difference between the number of man-hours demanded by and supplied to industry i at any given wage rate.

$$(II.17) \qquad \frac{dW_i}{dt} = f(XD_i)$$

and

$$(II.18) \qquad XD_i = MH_i - S_i$$

Both the demand function and the supply function explaining MH_i and S_i have been specified in the previous section.

As indicated in this earlier discussion, MH_i might conceivably be represented by either $\widehat{MH}_i$ or MH^* , but there is some reason to expect $\widehat{MH}_i$ to be a better indicator of the demand for labour in any quarter than MH^*_i . Moreover, as a check on the reasoning suggesting that wage changes are unlikely to be influenced by vacancies and redundancies once demand has been allowed for, one may replace $\widehat{MH}_i$ by MH^*_i and e_i from equation (II.13).

When MH_i in equation (II.18) is replaced by $\widehat{MH}_i$ and S_i by equation (II.16) we have

$$(II.19) \quad \frac{dW_i}{dt} = f(XD_i) = f[(\widehat{MH}_i)-(\beta_0 + \beta_1 W_i/W_T + \beta_2 U^{-2} + \beta_3 \, W_i/W_{us_i} +$$

$$\beta_4 \, \pi_{i_{-2}})]$$

If we were to adopt Walras' assumption that $\frac{dW}{dt}$ is proportional to the level of excess demand, XD, we could write $\frac{dW_i}{dt} = \gamma(XD_i)$ and equation (II.19) could then be reduced to

$$(II.20) \quad \frac{dW_i}{dt_1} = \lambda_0 + \gamma\widehat{MH}_i + \lambda_1 \, W_i/W_T + \lambda_2 U^{-2} + \lambda_3 \, W_i/W_{us_i} + \lambda_4 \, \pi_{i_{-2}}$$

where $\lambda_j = -\gamma\beta_j$.

However, because we assume supply is a function of relative wages, W_i/W_T and W_i/W_{us_i}, rather than the level of wages, W_i, this proportional rela-tionship will not hold in general. Nevertheless, it is feasible to try to approximate equation (II.19) with the following linear relationship.

$$(II.21) \quad \Delta W_i = \xi_0 + \xi_1\widehat{MH}_i + \xi_2 \, W_i/W_T + \xi_3 \, U^{-2} + \xi_4 \, W_i/W_{us_i} + \xi_5 \, \pi_{i_{-2}}$$

where $\Delta W_i \approx \frac{dW_i}{dt}$.

In this relationship ξ_1 can be expected to be positive—i.e., $\frac{\partial\Delta W_i}{\partial\widehat{MH}_i} > 0$. As the demand for labour increases wages can be expected to increase, ceteris paribus; and vice versa when the demand for labour decreases.

Since S_i, as pointed out earlier, can be expected to be positively associated with W_i/W_T, W_i/W_{us_i} and U and to be negatively associated

with $\pi_{i_{-2}}$ one would expect β_1 and β_3 to be positive in equation (II.16) and β_2 and β_4 to be negative:

$$\beta_1 = \frac{\partial S_i}{\partial W_i / W_T} > 0 \qquad\qquad \beta_3 = \frac{\partial S_i}{\partial W_i / W_{us_i}} > 0$$

$$\beta_2 = \frac{\partial S_i}{\partial U_{-2}} < 0 \qquad\qquad \beta_4 = \frac{\partial S_i}{\partial \pi_{i_{-2}}} < 0$$

If the Walrasian proportionality hypothesis applied, then in equation (II.20) one would expect $\lambda_1 < 0$, $\lambda_2 > 0$, $\lambda_3 < 0$ and $\lambda_4 > 0$. Although, as noted earlier, this hypothesis does not apply strictly because of our supply assumptions regarding relative prices it nevertheless is assumed that the signs for ξ_j correspond to the signs for λ_j. Thus,

$$\xi_2 = \frac{\partial \Delta W_i}{\partial W_i / W_T} < 0$$

$$\xi_3 = \frac{\partial \Delta W_i}{\partial U_{-2}} > 0$$

$$\xi_4 = \frac{\partial \Delta W_i}{\partial W_i / W_{us_i}} < 0$$

$$\xi_5 = \frac{\partial \Delta W_i}{\partial \pi_{i_{-2}}} > 0$$

As an alternative to the Walrasian assumption made above, one can make the assumption that underlies the "Phillips-curve" relationship,—namely

that the <u>percentage</u> rate of change in wages is related to excess demand as a <u>proportion</u> of the total supply of labour—i.e., $\frac{\Delta W}{W} = \frac{g(XD)}{(S)}$. The "Phillips-curve" hypothesis is less conventional and perhaps less plausible than the Walrasian hypothesis but one that has been rationalized in the literature. 22/ Because of the importance that $\dot{W}_i$ has assumed in the "Phillips-curve" literature a few of our relationships have also been fitted to explain $\frac{\Delta W_i}{W_i} = \dot{W}_i$ as well as ΔW_i . Our estimates, however, conform only partially to the "Phillips-curve" hypothesis since we estimate $\dot{W} = h(XD_i)$ rather than $\dot{W} = g\frac{(XD_i)}{(S_i)}$.

Before proceeding to the empirical evidence, a final point might be noted in connection with the role of productivity. As mentioned earlier in this section, there has been some disagreement among economists about the relative importance of productivity and profits as determinants of wages. Some investigators—particularly those who have fitted "Phillips-curves" have emphasized the importance of profits while others—such as E. Kuh— have argued that productivity is more important as a determinant of wages in the aggregate wage-adjustment relationship than profits. In our model both influences are allowed for separately. The role of productivity is implicitly allowed for in the production function from which the demand for labour is derived. The role of profits is explicitly allowed for in the supply relationship.

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1/   A.W. Phillips, "The Relationship Between Unemployment and the Rate of
Change of Money Wage Rates in the United Kingdom, 1861-1957", Economica
N.S., XXV (Nov. 1958) pp. 283-299. Richard C. Lipsey, "The Relation
Between Unemployment and the Rate of Change of Money Wage Rates in the
United Kingdom, 1862-1957; A Further Analysis", Economica N.S., XXVII
(Feb. 1960) pp. 1-31.

2/   For an extensive review of this research see Ronald G. Bodkin, Elizabeth
P. Bond, Grant L. Reuber, T. Russell Robinson, Price Stability and High
Employment: The Options for Canadian Economic Policy—an Econometric
Study, Special Study No. 5 prepared for the Economic Council of Canada
(Ottawa: Queen's Printer, 1967). For another review of this literature
and an alternative to a Phillips-curve analysis see E. Kuh, cited below.

3/   Bodkin, et. al., op. cit., Table 1 p. 124. Here and elsewhere in this
study, unless explicitly noted, the residual error terms have been
omitted from equations.

4/   This point has been particularly emphasized by Otto Eckstein and Thomas
A. Wilson, "The Determination of Money Wages in American Industry",
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and O. Eckstein, "Money Wage Determination Revisited", The Review of
Economic Studies XXXV(2):102 (April 1968) pp. 133-143. More attention
will be given to this hypothesis in Chapter IV below.

5/   E. Kuh, "A Productivity Theory of Wage Levels—An Alternative to the
Phillips Curve", The Review of Economic Studies XXXIV (4):100 (Oct.
1967) pp. 333-360.

6/   F. Brechling, "The Relationship Between Output and Employment in British
Manufacturing Industry", The Review of Economic Studies XXXII (3):91
(July 1965) pp. 187-216; R.J. Ball and E.B.A. St. Cyr, "Short-Term
Employment Functions in British Manufacturing Industry", The Review
of Economic Studies, XXXIII (3): 95 (July 1966) pp. 179-208; Frank
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facturing Industries: An International Comparison", The Review of
Economics and Statistics XLIX: (3) (Aug. 1967) pp. 277-287. Each paper
contains a brief bibliography on this subject.

7/   This summary follows closely the summary given in Brechling and O'Brien,
op. cit., pp. 277-8.

8/   See Ball and St. Cyr, op. cit., pp. 179-185. D.J. Smyth and N.J. Ireland
in "Short-Term Employment Functions in Australian Manufacturing", The
Review of Economics and Statistics XLIX (Nov. 1967) pp. 537-44, provide
an alternative derivation, starting with the less restrictive assumption
of a constant elasticity of substitution production function.

9/   Comparison of the value of R^2 strictly speaking does not provide a fully
satisfactory measure of the relative goodness of fit of these two forms.
The comparison should be between R^2 from equation (II.11) and r^2 $(y, \hat{y})$
where $\hat{y}$ is the antilogarithm of $\ln \hat{y}$ as estimated from equation (II.10).

10/ As evidenced, for example, in the following publications of the National
Bureau of Economic Research: Thor Hultgren, Changes in Labour Cost
During Cycles in Production and Business (Occasional Paper 74); Solomon
Fabricant, Basic Facts on Productivity Change (Occasional Paper 63);
John W. Kendrick, Productivity Trends in the United States (Princeton:
Princeton University Press, 1961).

11/ M.I. Naidiri in "The Effects of Relative Prices and Capacity on the
Demand for Labour in the United States Manufacturing Sector", The
Review of Economic Studies XXXV (July 1968) pp. 273-288, has extended
the log-linear form of equation (II.10) to include the relative price
of capital (user-cost of capital) and labour (wages) and the rate of
utilization of the capital stock. He found significant elasticities
for aggregate employment with respect to both factors. Though this
extension is recognized as desirable in principle, it was not feasible
to allow for either of these factors explicitly here because of lack
of data. This omission may not be as serious as at first sight it
might seem since our concern is with short-run changes in demand when
the elasticity of demand may be inelastic with respect to relative
price movements.

12/ $\widehat{MH}$ as estimated from equation (II.10) or (II.11) with the disturbance
assumed equal to zero.

13/ This distinction is analagous to the distinction that has been empha-
sized in consumption theory, especially in the writings of Milton
Friedman, between permanent and temporary changes in income.

14/ See, for example, a recent paper by Edmund S. Phelps and the references
cited there, "Money-Wage Dynamics and Labour-Market Equilibrium",
Conference of University Professors, American Bankers' Association,
September 1967, mimeographed.

15/ See page 16 above.

16/ However, on a strict interpretation of our model, it is doubtful whether
there is much to be gained by separating e into e_1 and e_2. This is
because both are estimated from a relationship—either equation (II.10)
or (II.11)—which implies that the reaction of employers to vacancies
and redundancies is the same. On a looser interpretation, however,
one might argue that e_1 and e_2 in any event are only rough approx-
imations and that if vacancies and redundancies did influence wages,
e_1 and e_2 might serve to indicate whether this influence was approx-
imately the same or not.

17/ Both concepts of the unemployment variable were employed in deriving
empirical estimates, as noted in Chapter III.

18/ Bodkin, et. al., op. cit., pp. 112-3, and Chapter 5.

19/ Bodkin, et. al., op. cit., p. 126.

20/ See, for example, Harry J. Waisglass, <u>Towards Equitable Income Distribu-</u>
     tion, (Toronto: National Office for Canada of the Steelworkers of
     America, 1966).

21/ See, for example, Paul Wonnacott and Ronald J. Wonnacott, "The Wage
     Parity Question", Special Study Prepared for the Task Force on Labour
     Relations, mimeographed, 1968.

22/ See, for example, Richard G. Lipsey, "The Relations Between Unemployment
     and the Rate of Change of Money Wage Rates in the United Kingdom, 1862-
     1957: A Further Analysis", <u>Economica</u> N.S. XXVII (Feb. 1960) pp. 12-15.
     Some of the more interesting recent theoretical literature based on
     this formulation includes: Charles C. Holt, "Job Search, Phillips Wage
     Relation and Union Influence, Theory and Evidence" and "How Can the
     Phillips Curve be Moved to Reduce Both Inflation and Unemployment"
     <u>Microeconomic Foundations of Employment and Inflation Theory</u>, Edmund S.
     Phelps Ed. (W.W. Nortin, forthcoming 1969); Bert Hausen, "Excess Demand,
     Unemployment, Vacancies and Wages", (mimeographed, 1969); Edmund S.
     Phelps, "Money-Wage Dynamics and Labour-Market Equilibrium" <u>op. cit.</u>

CHAPTER III

EMPIRICAL ESTIMATES OF INDUSTRY WAGE CHANGE RELATIONSHIPS

Equation (II.21) is the basic relationship on which the empirical
analysis of this Chapter is based. Multivariate regression analysis has
been employed throughout, applying the techniques of Ordinary Least Squares
(OLS) and Two-Stage Least Squares (TSLS). In order to estimate the model
outlined in Chapter II, a two-stage procedure has been followed. In stage
I employment functions have been fitted for individual two-digit industries
from which values of $\hat{MH}_i$ and MH^*_i have been derived. In stage II, equations
of the form of equation (II.21) have been fitted for these same industries.

Estimates have been made employing both annual and quarterly data for
the sample period from 1953 to 1966 inclusive. Annual estimates were made
to provide a check on the quarterly estimates. For some of the statistical
series, such as unit profits, the annual figures are perhaps more accurate
than the quarterly data. Apart from the accuracy of the underlying data,
annual estimates avoid the problems associated with seasonality. In addi-
tion, because of the longer interval between observations, estimates based
on annual data may be less complicated by lag relationships and dynamic
adjustments than estimates based on quarterly data. The primary reason, of
course, why it is not very satisfactory to rely on annual estimates and why

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quarterly estimates are preferable is because of the limited number of observations available on an annual basis. With 13 observations from 1953 to 1966 and 6 parameters to be estimated in equation (II.21) one is left with only 7 degrees of freedom. Such limited degrees of freedom necessarily undermine the confidence that one can place in the estimates. In addition to this consideration, the behavioural time unit may be shorter than a year.

A serious statistical difficulty encountered in estimating the relationships in question has been the reclassification of industry data during the 1960's. In order to have a long enough period of historical experience to make it feasible to estimate these relationships, an attempt was made to regroup the new classifications to conform with the old classifications. This has proven very difficult in a number of instances and it seems likely that, in some cases at least, old and new data have not been matched up completely satisfactorily. Details regarding the matching of these series are given in the Appendix. The industries for which the problems of matching up data seemed particularly difficult are iron and steel and non-ferrous metals. The distortions in our estimates that may arise from this source are likely to be more serious for the annual estimates than for the quarterly estimates, given the much smaller number of observations on which our annual estimates are based.

In presenting the empirical analysis based on equation (II.21), attention first is given to the estimates of the employment relationships. This is followed by a discussion of the estimated wage-change relationships. Primary emphasis is placed on the quarterly estimates which are superior in several respects to the annual estimates. Occasional reference is made to the annual estimates where these usefully supplement the evidence derived from the quarterly data.

1. Employment Functions

In order to estimate the employment functions described in Chapter II, it was necessary to resolve several questions relating to estimating procedure. The first question arises because of the interdependence between employment and output. A change in Q_i affects MH_i but at the same time a change in MH_i affects Q_i. Because of this simultaneous two-way relationship between output and employment, ordinary least squares estimates are likely to be biased. In order to guard against this possibility, the employment functions for each industry were fitted by two-stage least squares (TSLS) as well as by ordinary least squares (OLS). The TSLS model fitted for the linear estimates was as follows:

$$(\text{III.1}) \quad Q_i = r_0 t + r_1 U^{*-2} + r_2 \Pi^{*}_{i_{-2}} + r_3 MH_{i_{-1}} + r_4 D_1 + r_5 D_2 + r_6 D_3 + r_7 D_4$$

$$(\text{III.2}) \quad MH_i = s_0 t + s_1 \hat{Q}_i + s_2 MH_{i_{-1}} + s_3 D_1 + s_4 D_2 + s_5 D_3 + s_6 D_4$$

where the notation is the same as in Chapter II, r_j and s_j are the parameters that were estimated, $\hat{Q}_i$ is the estimated value of Q_i from equation (III.1) and t, U^{*-2}, $\Pi^{*}_{i_{-2}}$, $MH_{i_{-1}}$, D_1, D_2, D_3 and D_4 are predetermined variables. In the TSLS model fitted to estimate the log-linear employment function, logarithms to the base e were used in place of untransformed data for Q_i, $\Pi^{*}_{i_{-2}}$, MH_i and $MH_{i_{-1}}$.

A second question that had to be resolved was whether to employ a simple linear relationship like equation (II.11) or a log-linear relationship like equation (II.10). As indicated earlier, one criterion for choosing one form over the other is goodness of fit which may be approximately indicated by the value of $\bar{R}^2$. Employment functions of both forms were fitted to

quarterly data for each two-digit industry. When fitted by OLS the value
of $\bar{R}^2$ for each form of the equation was approximately the same for each
industry with three exceptions—transportation equipment, chemicals and non-
metallic minerals. In these three industries the value of $\bar{R}^2$ for the linear
relationship was substantially greater than for the log-linear relationship.
On this basis it was decided to employ only the linear estimates of the
employment function derived by OLS. When the employment functions were
fitted by TSLS, the linear form also performed as well or better than the
log-linear form, judged on the basis of the value of $\bar{R}^2$. For five indus-
tries—textiles, clothing, paper, printing and iron and steel—where there
was little to choose between the two forms of the equation in terms of the
value of $\bar{R}^2$, both forms have been used in the analysis that follows. In
other industries where the linear form outperformed the log-linear form
only the linear form of the TSLS estimates has been used. Only the simple
linear form was fitted to annual data.

A third question that was considered was whether, for the purpose of
deriving estimates of $\hat{MH}_i$, MH_i^* and e, one should include or exclude var-
iables in the employment functions for which the regression coefficients
are not significantly different from zero on the basis of conventional tests
of statistical significance. It was decided to include all the variables
in the employment function irrespective of the statistical significance of
the parameters on the ground that the parameters represent the "best" point
estimates of the relationships in question even though these "best" estimates
may not warrant much confidence.

A related question concerns the treatment of variables for which the
estimated parameters have the wrong sign. The theory underlying the employ-
ment relationship described in Chapter II implies that α_1 and α_1' in equations

(II.10) and (II.11) are positive,

$$\frac{\partial \ln MH_i}{\partial \ln Q_i} = \alpha_1 > 0$$

$$\frac{\partial MH_i}{\partial Q_i} = \alpha_1' > 0$$

One would expect productivity to improve over time or, at worst, remain unchanged; a decrease in productivity in any two-digit manufacturing industry in Canada from 1953 to 1966 seems highly implausible. Hence one would expect α_2 and α_2' in equations (II.10) and (II.11) to be negative implying that over time the same output could be produced with a decreasing number of man-hour inputs.

$$\frac{\partial \ln MH_i}{\partial t} = \alpha_2 \leqslant 0$$

$$\frac{\partial MH_i}{\partial t} = \alpha_2' \leqslant 0$$

In addition, the theory underlying the adjustment lag included in the employment function implies that the coefficient of MH_{-1} falls between 0 and 1; otherwise an unstable adjustment process is implied and the rationale of including an adjustment lag is called into serious question. Hence,

$$0 < \frac{\partial \ln MH_i}{\partial \ln MH_{i_{-1}}} = \alpha_3 < 1$$

and

$$0 < \frac{\partial MH_i}{\partial MH_{i_{-1}}} = \alpha_3' < 1$$

Finally, it is apparent that the coefficients of the constant terms may be either positive or negative.

In the employment functions estimated for purposes of this study, variables for which the associated parameters had the wrong sign were omitted from the estimated equations. This seemed preferable to the alternative of including those variables with wrongly signed coefficients, since parameters with the wrong sign indicate either statistical difficulties or inappropriate theory. This problem arose in only a few instances.

Table III.1 presents the quarterly estimates of the employment functions from which estimated values of the demand for labour have been derived for the next stage of the analysis. The statistical sources on which these estimates are based and the definitions of the variables are given in the Appendix.

The lag structure implied by the quarterly estimates shown in Table III.1 is indicated in Table III.2. These figures indicate the percentage of the final effect on MH_i realized at the end of each quarter following an exogenous disturbance in any of the determinants of MH. Not much will be made of this information in the present study beyond pointing out that the adjustment patterns seem to differ considerably from industry to industry. A comparatively long adjustment process is indicated for textiles, paper, printing, iron and steel, non ferrous metals and electrical apparatus. On the other hand, most of the adjustment in employment to an exogenous disturbance in output will have occurred within two quarters after the disturbance in the food and beverage industry and in the clothing, transportation equipment, non-metallic mineral and chemical industries.

TABLE III.1

ESTIMATED EMPLOYMENT FUNCTIONS: TWO-DIGIT MANUFACTURING INDUSTRIES, QUARTERLY, 1953-66

INDUSTRY	Food and Beverages		Rubber		Textiles			Clothing		
Equation Number	1	2	3	4	5	6	7	8	9	10
Equation Estimated	II.11	II.11	II.11	II.11	II.11	II.11	II.10	II.11	II.11	II.10
Method of Estimation	OLS	TSLS	OLS	TSLS	OLS	TSLS	TSLS	OLS	TSLS	TSLS
Explanatory Variables										
Q_i	6.554 [1.63]	10.26 [1.44]	8.018 [3.81]	17.67 [0.81]	8.354 [6.04]	6.528 [3.26]	0.3994 [3.33]	15.74 [7.18]	14.70 [5.46]	0.7778 [5.89]
t	-0.2185 [0.03]	-3.947 [.53]	-13.43 [3.25]	-35.10 [0.79]	-18.32 [5.60]	-14.12 [3.02]	-0.005688 [3.18]	-13.49 [4.26]	-12.07 [3.16]	-0.005348 [4.07]
MH_{i-1}	0.1463 [0.98]	0.1113 [.69]	0.515 [4.58]	0.1434 [0.17]	0.5510 [7.22]	0.6301 [6.35]	0.6055 [5.92]			
D_1	2607 [3.95]	2415 [3.28]	1085 [3.15]	1518 [1.43]	753.4 [4.16]	634.2 [3.24]	1.363 [3.34]	1774 [7.58]	1865 [6.94]	4.504 [7.36]
D_2	2951 [4.63]	2666 [3.40]	1121 [3.34]	1494 [1.60]	729.1 [4.14]	628.4 [3.21]	1.359 [3.33]	1763 [8.01]	1869 [6.61]	4.494 [7.28]
D_3	3385 [3.76]	3048 [3.39]	1376 [3.85]	2012 [1.35]	859.6 [4.70]	738.3 [3.56]	1.402 [3.40]	1761 [7.61]	1876 [7.05]	4.508 [7.38]
D_4	2864 [3.76]	2598 [2.97]	1067 [3.07]	1499 [1.41]	760.4 [4.34]	664.6 [3.44]	1.371 [3.36]	1775 [8.15]	1883 [6.58]	4.492 [7.26]
$\bar{R}^2$	.88	[.87]	.77	.66	.91	.91	.92	.71	.71	.71
D.W.	1.90	11.93	1.71	1.19	2.13	2.17	2.36	2.67	2.64	3.02

TABLE III.1 (Cont'd)

	Paper and Products			Printing			Iron and Steel			Transportation Equipment	
	11	12	13	14	15	16	17	18	19	20	21
	II.11	II.11	II.10	II.11	II.11	II.10	II.11	II.11	II.10	II.11	II.11
	OLS	TSLS	TSLS	OLS	TSLS	TSLS	OLS	TSLS	TSLS	OLS	TSLS
Q_i	10.23 [4.05]	16.78 [4.13]	0.3264 [3.43]	7.580 [3.65]	10.91 [3.56]	0.1418 [1.76]	12.86 [8.25]	12.73 [4.63]	0.3213 [3.16]	15.87 [4.39]	20.82 [4.25]
t	-12.78 [3.11]	-22.45 [3.57]	-0.002704 [2.76]	-9.147 [2.59]	-14.21 [2.88]	-.000755 [.95]	-17.03 [6.20]	-16.82 [3.74]	-0.002423 [2.35]	-26.94 [2.61]	-38.29 [2.97]
MH_{i-1}	0.6868 [8.24]	0.5575 [5.14]	0.7163 [8.69]	0.7583 [9.09]	0.6842 [6.93]	0.8418 [9.84]	0.4531 [6.48]	0.4581 [4.07]	0.6455 [6.26]	0.1121 [0.80]	0.003057 [.02]
D_1	237.5 [0.73]	163.5 [0.46]	0.8242 [1.45]	96.85 [0.32]	-2.20 [.01]	.6367 [.98]	806.3 [5.00]	799.7 [4.00]	1.422 [3.10]	2471 [4.26]	2387 [4.01]
D_2	492.3 [1.54]	356.9 [1.02]	.8789 [1.53]	76.62 [0.24]	-42.31 [.13]	.6328 [.97]	876.6 [5.66]	871.0 [4.73]	1.445 [3.17]	2451 [3.84]	2351 [3.59]
D_3	567.2 [1.71]	469.8 [1.31]	.8906 [1.54]	121.0 [0.39]	34.12 [.11]	.6406 [.98]	847.7 [5.05]	840.6 [4.02]	1.426 [3.09]	2850 [4.22]	3058 [4.35]
D_4	200.6 [0.58]	131.7 [0.35]	.8203 [1.41]	26.28 [0.08]	-89.78 [.27]	.6289 [.97]	762.4 [4.54]	755.3 [3.61]	1.410 [3.06]	2264 [3.73]	2269 [3.66]
$\bar{R}^2$	.90	.89	.90	.93	.93	.92	.97	.97	.96*	.44	.41
D.W.	1.77	1.40	1.91	2.74	2.76	2.41	2.44	2.44	1.78	2.25	2.11

TABLE III.1 (Concluded)

	Non-ferrous Metals		Electrical Apparatus	Non-metallic Minerals	Chemicals	
	22	23	24	25	26	27
	II.11	II.11	II.11	II.11	II.11	II.11
	OLS	TSLS	OLS	TSLS	OLS	TSLS
Q_1	19.68 [5.45]	24.63 [1.77]	7.771 [6.36]	18.34 [8.63]	8.297 [1.41]	6.931 [0.86]
t	-21.56 [4.46]	-27.76 [1.59]	-13.53 [4.29]		-7.208 [0.28]	-1.772 [0.05]
MH_{i-1}	0.5944 [7.16]	.5255 [2.56]	0.6053 [8.74]			.005332 [0.03]
D_1	-305.2 [0.83]	-532.2 [.74]	956.4 [3.81]	2348 [5.46]	3509 [4.02]	3801 [3.07]
D_2	-243.5 [0.66]	-480.9 [.65]	1106 [4.50]	2115 [4.18]	3622 [3.99]	3540 [3.05]
D_3	160.0 [0.44]	-372.6 [.54]	1114 [4.55]	1649 [2.97]	3380 [4.07]	3727 [3.16]
D_4	-309.0 [0.83]	-538.9 [.74]	939.8 [3.95]	2042 [3.97]	3557 [4.10]	3679 [3.07]
$\bar{R}^2$	.86	.86	.97	.61	.29	.27
D.W.	1.75	1.52	1.63	[2.13]	2.02	2.02

TABLE III.2

ESTIMATED LAG STRUCTURE IN THE ADJUSTMENT
OF EMPLOYMENT TO EXOGENOUS DISTURBANCES

Industry	Equation Number from Table III.1	Percentage of Final Effect Realized at the End of Each Quarter Following an Exogenous Disturbance					
		Current	1	2	3	4	5
Food and Beverages	1	85	98				
	2	89	99				
Rubber	3	48	74	87	93	97	
	4	79	96				
Textiles	5	45	70	83	91	95	94
	6	37	60	75	84	91	95
	7	39	63	78	87	92	
Paper	11	31	52	67	77	84	89
	12	45	69	83	91	95	86
	13	28	49	63	74	81	
Printing	14	24	42	56	67	75	81
	15	32	53	68	78	85	90
	16	16	29	40	50	58	64
Iron and Steel	17	55	80	91	96		
	18	56	79	90	96	89	93
	19	35	58	73	83		
Transportation Equipment	20	89	99				
	21	97					
Non-ferrous Metals	22	41	65	79	88	93	96
	23	47	72	85	92	96	
Electrical Apparatus	24	39	63	77	86	92	95

Several features of the equations presented in Table III.1 may be briefly noted. First and not surprisingly perhaps, the t-ratios associated with the estimated coefficients for lagged values of MH_i generally indicate that the coefficients for this variable are statistically significant in industries where the adjustment lag, as shown in Table III.2, exceeds two quarters. In industries where the adjustment lag is less than two quarters the estimated coefficient for MH_i is frequently insignificant, suggesting that there is considerable doubt whether there is a lag or not when the lag is quite short. Secondly, the estimated coefficients for Q_i are statistically significant for most equations. The most noteworthy exception occurs in the food and beverage and chemicals industries where the coefficients of Q_i are not statistically significant but have the correct sign. Most of the estimated coefficients for t are also statistically significant, though the t-ratios are somewhat less than those associated with the coefficients of Q_i and there are several more instances where the coefficient of t is insignificant. Thirdly, the value of $\overline{R}^2$ in most cases exceeds .70, indicating that the estimated relationships explain quite a high percentage of the variation in labour inputs. In three industries, however, the estimates are not very satisfactory if one judges on the basis of this criterion: transportation equipment, non-metallic minerals and chemicals. For these industries the estimated values of $\overline{R}^2$ range from .61 to .27. The equations for chemicals are the least satisfactory from this standpoint with values of $\overline{R}^2$ of .29 and .27. Finally it may be noted that although the OLS estimate for electrical apparatus seems quite satisfactory, the TSLS estimate was unsatisfactory: the coefficients for both Q_i and t had the wrong sign, though in neither case was the coefficient statistically significant.

The annual estimates are not presented but it is worth mentioning that the coefficients for lagged values of MH_i are generally smaller and more frequently insignificant than the corresponding quarterly coefficients. This is what one would expect on the basis of the evidence presented in Table III.2 and in the paper by Brechling and O'Brien which indicates that in many industries the lag in the adjustment of employment to changes in output has been largely completed within a year. As with the quarterly estimates, the coefficients for Q_i and t are highly significant for most estimates though in two instances the coefficient for t has the wrong sign. The estimated values of $\bar{R}^2$ are high, exceeding .8 in all cases.

Finally, a brief reference may be made to the estimated values of the Durbin-Watson statistic. In equations which include lagged values of the dependent variable, this statistic cannot be relied upon to indicate the presence of serial correlation; hence this statistic is of little significance for the equations shown above.

2. Definition of the Variables Included in the Estimated Wage Change Relationships

The second stage of the analysis has consisted of estimating equation (II.21). Corresponding to the estimates of the employment functions, estimates of equation (II.21) have been made employing both annual and quarterly data for two-digit industry categories. A simple linear form of the relationship has been fitted by ordinary least squares in all cases.

As indicated in Chapter II, two concepts of the rate of change in wages have been employed in this study. The first, ΔW_i, fits our theoretical framework somewhat more logically. The second, $\dot{W}$, is of interest because of the prominence it has attained in "Phillips-curve" analysis. The two

conceptions are rather similar and the estimates of the wage change relationships do not differ much when ΔW is replaced by $\dot{W}$, though equations explaining ΔW generally are superior to those explaining $\dot{W}$.

a) Quarterly Estimates

In fitting equations to quarterly data the question of lag relationships becomes particularly important because the time span between observations during which variables can interact is very short and the reaction time between variables can be expected to differ. Consequently, it becomes important to allow for lag relationships in a satisfactory manner in order to guard against spurious or badly inaccurate estimates. How best to allow for these lag relationships is a very difficult question which for the most part can only be answered empirically. Two approaches have been adopted for this study, both of which were employed in earlier work by Bodkin et al. on the aggregative wage-adjustment relationship in Canada.

The first approach that has been followed has been to build a distributed lag effect into the form of some of the variables and to include lagged values of some of the explanatory variables. This procedure is followed in the Brookings model as well as in the estimated aggregate wage-adjustment relationship for Canada shown as equation (II.1) $\underline{1}/$. The second approach has been to include lagged values of the dependent variable as an explanatory variable, following a procedure developed by L.M. Koyck $\underline{2}/$.

The dependent variables, ΔX_i , and $\dot{X}_i$ have been defined as follows:

$$\Delta X_{i_t} = W_{i_t} - W_{i_{t-4}}$$

where W_i is average hourly earnings of production workers in the ith industry (Dominion Bureau of Statistics)

$$\dot{X}_{i_t} = \frac{W_{i_t} - W_{i_{t-4}}}{W_{i_{t-4}}} \cdot 100$$

In effect, this definition defines the rate of change in wages in terms of the absolute or percentage change in wages between any quarter and the same quarter a year earlier. In this manner, the problem of allowing for seasonality is very largely eliminated. At the same time, this definition allows for some stickiness in wages and allows more time for wage changes to manifest themselves in the statistics. A number of experiments were made using ΔW and $\dot{W}$ as the dependent variables:

$$\Delta W_{i_t} = W_{i_t} - W_{i_{t-1}}$$

$$\dot{W}_{i_t} = \frac{W_{i_t} - W_{i_{t-1}}}{W_{i_{t-1}}} \cdot 100$$

These experiments were much less successful than those based on ΔX and $\dot{X}$. In addition to the problem of seasonality, the relatively limited variation in quarter-to-quarter changes in wages means that errors in the statistics can more readily give rise to erroneous estimates or can obscure relationships.

The estimated demand variables, $\widehat{MH}_i$ and MH_i^*, were derived from the estimated employment functions in the manner already described. These variables were included in the relationship without a lag—i.e., as $\widehat{MH}_{i_t}$ and $MH_{i_t}^*$—since the employment function from which these estimates are derived already allow for an adjustment lag. Similarly in the tests made with e and e_1 and e_2, these variables were included in the relationship without

a lag. All estimates of MH_i^* and e_i used in the experiments undertaken were
derived from the OLS estimates of equation (II.11). Estimates of $\widehat{MH}_i$ were
derived from two sets of equations. When identified as $\widehat{MH}_{1_i}$ in the equations
presented below, they were derived from the OLS estimates of equation
(II.11); when identified as $\widehat{MH}_{2_i}$ they were derived from the TSLS estimates
of equation (II.11). 3/

The unemployment variable was defined as follows:

$$U_t^* = \frac{1}{8} U_t + \frac{1}{4} \sum_{j=1}^{3} U_{t-1} + \frac{1}{8} U_{t-4}$$

where U_t is the percentage of the labour force in the manufacturing sector of the economy that is unemployed in the tth quarter (Dominion Bureau of Statistics).

In most experiments U_t^{*-2} was included in the relationship implying the non-
linear form referred to earlier. In some experiments the linear form, U_t^*,
was substituted for U_t^{*-2}. In other experiments the unemployment rate for
the whole economy was used instead of the unemployment rate in the manufac-
turing sector only. This substitution did not have much effect on the
empirical estimates. One might argue that there is such a high degree of
labour mobility between manufacturing and other sectors of the economy that
the unemployment rate for the whole economy is preferable to the unemployment
rate for manufacturing only. The latter has been used on the ground that
there is sufficient labour immobility between manufacturing and other sectors
of the economy to justify the use of the unemployment rate for the manufac-
turing sector only. This immobility is thought to reflect partly a dif-
ference in skills and training and partly locational immobility.

The relative wage variables, W_i/W_T and W_i/W_{us_i}, were defined as follows:

(W_i/W_{T_t}) where W_i and W_T are the average hourly earnings of production workers in the ith industry and in all manufacturing, respectively, at time t (Dominion Bureau of Statistics).

$(W_i/W_{us_{i_t}})$ where W_i has the foregoing definition and W_{us_i} is average hourly earnings of production workers in the ith industry in the United States at time t (United States Department of Commerce).

$(W_i/W_T)_{t-4}$ is (W_i/W_T) with a four period lag.

$(W_i/W_{us_i})_{t-4}$ is (W_i/W_{us_i}) with a four period lag.

In explaining the change or percentage change of wages from time t-4 to t, one must decide whether to date the relative wage variables, which enter the equation as relative wage levels, at the beginning or at the end of the period over which the change in wages occurs. The latter procedure has been followed in some investigations and can be justified on the ground that employees and employers anticipate wage changes. However, given that the assumed casual relationship runs from relative wage levels to changes in wages, it seems rather more plausible to expect the relative level of wages today to have whatever effect it has on wages over the coming year rather than for the relative level of wages today to affect wage changes over the past year. 4/

The profits variable has been defined as follows:

$$\pi^*_{i_t} = \frac{1}{4} \sum_{j=0}^{3} (Z_i/Q_i)_{t-j} \cdot 100 = \text{four-quarter moving average of the profit markup on output in the } i^{th} \text{ industry (i.e., profits per unit of output in the } i^{th} \text{ industry as an index)}$$

Z_i = corporate profits before tax in the ith industry (Dominion Bureau of Statistics);

Q_i = index of industrial production in the ith industry, (1949 = 100) (Dominion Bureau of Statistics).

This variable, π_i^*, was included in the relationship with a two-quarter lag on the basis of the evidence of the existence of such a lag in the aggregative wage-adjustment relationship estimated by Bodkin et al. Entering this variable with a lag has the further advantage that one avoids, partially at least, the simultaneous relationship which is likely to exist between profits and wages. Although the level of profits may affect wage changes, one would also expect changes in wages to affect the level of profits. The inclusion of profits in the estimated equation with a two-quarter lag means that profits are partially predetermined—profits are calculated for the period from t-6 to t-2 and wage changes for the period from t-4 to t.

It is apparent that U^* and π^* have the same form as in the study by Bodkin et al. A distributed lag is built into these variables by using a four-quarter moving average for π^* and a five-quarter moving average, with appropriately adjusted weights, for U^*. It is recognized that a different form of the variables might have been chosen, for example, by averaging over a different number of quarters or by assigning different weights to each quarter. It is also recognized that by employing overlapping time intervals artificial serial correlation may be introduced into the estimates, thereby introducing an upward bias in the estimated value of the t-ratios. 5/ However, with the resources available it was not possible to experiment with alternatives and the forms used by Bodkin et al. were considered reasonably satisfactory. Moreover, from the standpoint of comparing the results of this study with the estimated aggregate wage-adjustment

relationships already available there is some advantage in having the variables expressed in the same form.

Most of the fitted relationships based on equation (II.21) did not include lagged values of the dependent variables—i.e., ΔX_{t-4} and $\dot{X}_{t-4}$— as an explanatory variable but each of the "best" estimates of the equation were re-run with one of these variables added to the equation. As noted earlier, this procedure may be used to allow for lags in the adjustment of wages to changes in the explanatory variables. This may be illustrated with the aid of Figure VI which is similar to Figure II. Given the level of demand D_i and the supply function $S_i(W_T)$, the equilibrium wage is oa when W_T is equal to W_{T_1}. When W_{T_1} changes to W_{T_2}, the new equilibrium wage is oc. However, because of inertia and built-in immobility in the short-run on the part of both employers and employees, lack of information and other reasons, the employer may not increase wages by the full amount ac in the current quarter, increasing them instead by perhaps only ad in the current quarter and by cd in subsequent quarters.
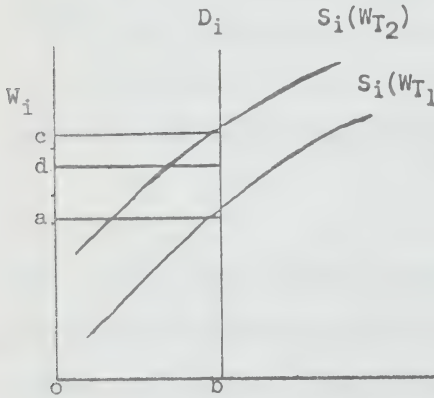
Figure VI

Some allowance for such a lag in the adjustment process has already been provided for via the form in which some variables have been included in equation (II.21) and the dating conventions adopted for the variables. The addition of a Koyck-type distributed lag to the relationship makes

additional provision for a lag in the adjustment process. One difficulty
that arises in connection with this procedure is that serial correlation
may be introduced into the error terms (if these originally were randomly
distributed) with the result that the parameter estimates may be biased.
Nevertheless, this method of allowing for lags has been employed widely in
empirical work in economics, including the estimation of aggregate wage-
adjustment relationships.

b) Annual Estimates

For the annual estimates variables were included in the relationship
in the following form:

$$\Delta W_{i_t} = W_{i_t} - W_{i_{t-1}}$$

where W_i is average hourly earnings of produc-
tion workers in industry i in year t and
year $t-1$.

$$\dot{W}_{i_t} = \frac{W_{i_t} - W_{i_{t-1}}}{W_{i_{t-1}}} \cdot 100$$

$$U_t^{-2} = \frac{1}{U^2}$$

where U is the percentage of the labour force
in the manufacturing sector of the economy
that is unemployed in year t.

$$(W_i/W_T)_{t-1}$$

where W_i and W_T are the average hourly earnings
of production workers in the ith industry and
in all manufacturing, respectively, in year
$t-1$.

$$(W_i/W_{us_i})_{t-1}$$

where W_i has the foregoing definition and
W_{us_i} is average hourly earnings of production
workers in the ith industry in the United
States in year t.

$$\pi_{i_{t-1}} = $$

profits per unit of output in the ith industry
in year $t-1 = (Z/Q)_{t-1}$ where Z and Q
are defined in the same way as for the quar-
terly estimates.

The values of $\hat{MH}$, MH^*, e, e_1 and e_2 were derived from the annual estimates of the employment function and were included in the estimated relationships without a lag.

3. The Estimated Wage-Change Relationships

Selected estimates of the postulated wage-change relationship for various industries are presented in Table III.3, based on quarterly data from 1953 to 1966. These estimates have been selected on the basis of several criteria including: goodness of fit as indicated by the value $\bar{R}^2$; the absence of serial correlation as signified by the size of the Durbin-Watson statistic; the size of the t-ratios; the appropriateness of the signs of the estimated coefficients and the reasonableness of the coefficients themselves. Although some of the estimates presented in Table III.3 are reasonably satisfactory when judged in these terms, it is evident that others are less satisfactory. 6/ It is also noteworthy that the quarterly estimates that have not been selected for inclusion in Table III.3 as well as most of the annual estimates are less satisfactory on balance than the estimates shown in Table III.3. Finally, as already mentioned MH^*_i and e_i were included in various tests; in general these proved to be unsatisfactory explanatory variables, confirming the presumptions noted earlier, and no further reference will be made to these variables.

A primary purpose of these estimates has been to try to identify empirically the factors that are particularly important in explaining wage changes in various industries from 1953 to 1966. The theoretical model on which the estimates are based allows for five basic factors—the level of unemployment, the relationship between wages in this industry and wage

TABLE III.3

ESTIMATED WAGE CHANGE RELATIONSHIPS: TWO DIGIT MANUFACTURING INDUSTRIES, QUARTERLY 1953-66

Dependent Variable: ΔX_i

Industry	Food & Beverages		Rubber		Textiles	
Equation Number	1	2	3	4	5	6
Explanatory Variables						
U^{*-2}	0.315 [2.62]	0.282 [2.68]	0.654 [2.66]	0.677 [2.89]	0.789 [5.08]	0.728 [5.10]
$(W_i/W_T)_{-4}$	-.259 [0.97]	-0.537 [2.20]	-1.151 [3.76]	-1.336 [4.43]	-0.675 [2.21]	-0.564 [2.01]
$(W_i/W_{us})_{-4}$	0.740 [0.25]	0.157 [0.52]	0.0915 [0.53]	-0.00770 [0.05]	0.564 [4.58]	0.328 [2.44]
π^*_{-2}	-.193 [1.38]	0.211 [1.73]	-.165 [0.17]	-0.333 [0.37]	-0.0806 [0.43]	-0.104 [0.61]
$\hat{MH}_1$						
$\hat{MH}_2$	-0.00000711 [0.76]	-0.0000145 [1.74]	0.0000235 [1.54]	0.0000217 [1.49]	-0.0000310 [1.49]	-0.0000243 [1.27]
ΔX_{-4}		0.425 [3.86]		0.277 [2.37]		0.416 [3.18]
Constant	0.170 [1.01]	0.372 [2.39]	1.051 [3.30]	1.313 [4.07]	0.175 [0.72]	0.250 [1.11]
$\bar{R}^2$	.25	.43	.60	.63	.66	.72
D.W.	.80	1.15	.93	1.18	.99	1.28

TABLE III.3 (Cont'd)

	Clothing				Paper		Printing		
	7	8	9	10	11	12	13	14	15
U^{*-2}	0.384 [3.55]	0.368 [3.57]	0.466 [4.60]	0.475 [4.76]	1.203 [4.55]	0.267 [2.54]	0.0575 [0.44]	0.248 [2.32]	0.00307 [0.02]
$(W_i/W_T)_{-4}$	-0.592 [2.84]	-0.643 [3.25]	-0.550 [2.64]	-0.553 [2.70]	-0.407 [1.92]	-0.792 [3.34]	-0.745 [3.35]	-0.762 [3.18]	-0.688 [3.09]
$(W_i/W_{us_i})_{-4}$	0.289 [1.85]	0.285 [1.92]	0.456 [3.65]	0.499 [3.97]	-0.829 [2.21]	0.584 [4.12]	0.320 [1.88]	0.591 [4.17]	0.301 [1.78]
π^*_{-2}	0.0226 [0.15]	0.0631 [0.43]	0.148 [1.07]	0.205 [1.45]	-0.349 [4.23]	0.0104 [0.55]	0.000337 [0.01]	0.00977 [0.33]	-0.00161 [0.058]
$\hat{MH}_1$	0.0000409 [1.57]		-0.00000483 [1.04]	-0.00000347 [0.75]	-0.0000130 [0.61]	0.00000156 [0.37]		0.00000336 [2.61]	0.0000485 [2.82]
$\hat{MH}_2$		0.0000615 [2.37]					0.0000419 [2.48]		
ΔX_{-4}		-0.294 [2.51]		-0.189 [1.59]				-0.120 [0.99]	-0.160 [1.51]
Constant	0.0538 [0.36]	0.0240 [0.17]	0.0500 [0.33]	0.0153 [0.10]	1.478 [4.01]	0.562 [2.87]	0.526 [2.88]	0.523 [2.61]	0.456 [2.45]
$\bar{R}^2$	.61	.65	.60	.61	.67	.34	.42	.34	.43
D.W.	1.47	1.49	1.62	1.60	.94	1.21	1.08	1.16	.97

TABLE III.3 (Cont'd)

	Iron and Steel		Transportation Equipment		Electrical Apparatus
	16	17	18	19	20
U^*_{-2}	-1.074 [1.64]	0.0153* [1.37]	-0.675 [2.35]	-0.744 [2.71]	0.647 [5.55]
$(W_i/W_T)_{-4}$	-0.143 [0.22]	-0.0328 [0.05]	0.421 [1.27]	0.485 [1.53]	-0.527 [3.33]
$(W_i/W_{us})_{-4}$	-0.523 [0.65]	-0.505 [0.62]	-0.978 [1.56]	-0.0962 [0.14]	-0.636 [2.92]
π^*_{-2}	-0.0443 [0.35]	-0.065 [0.52]	0.137 [2.86]	0.210 [3.85]	0.577 [3.10]
$\hat{MH}_1$	-.000114 [2.64]				-0.00000442 [1.41]
$\hat{MH}_2$		0.0000928 [2.50]	0.0000458 [3.26]	0.0000345 [2.44]	
ΔX_{-4}				-0.493 [2.42]	
Constant	0.275 [1.42]	0.116 [0.55]	0.0414 [0.17]	-0.656 [1.78]	1.058 [5.27]
$\bar{R}^{-2}$	.15	.01	.20	.29	.64
D.W.	.65	.67	1.44	1.29	1.46

* U^* is substituted for U^{*-2}

TABLE III.? (Concluded)

	Non-ferrous Metals				Chemicals		Non-metallic Minerals	
	21	22	23	24	25*	26*	27	2
y^*_{-1}	0.762 [0.80]	-0.026 [0.06]	0.028? [0.05]	-0.168 [0.88]	19.68 [2.91]	5.??? [0.77]	0.574 [5.10]	0.566 [5.0?]
$(W_1/W_2)_{-1}$	-1.?6? [?.?8]	-2.022 [2.?1]	-1.?11 [?.01]	0.606 [1.4?]	0.891 [0.094]	11.2? [1.??]	-0.??0 [1.9?]	-?.?1? [1.6?]
$(W_1/w_3)_{-1}$	0.8512 [1.21]	0.552 [0.69]	1.025 [1.9?]	-2.314 [3.60]	-60.28 [3.62]	-12?.7 [5.06]	0.536 [2.55]	0.488 [2.02]
π^*_{-2}	0.?21 [2.??]	0.266 [1.77]	0.40? [2.90]	0.011? [0.1?]	1.707 [0.52]	2.131 [0.72]	-0.340 [0.82]	-0.266 [0.61]
$\hat{MH}_{-1}$			0.0000229 [1.34]		0.000317 [1.34]			
$\hat{MH}_2$	0.000129 [2.79]	0.000120 [2.48]		0.0000832 [3.56]		0.00031? [3.41]	0.0000133 [2.66]	0.0000127 [2.49]
ΔX_{-1}		0.208 [0.79]			0.161 [1.67]	0.200 [2.39]	0.0823 [0.65]	
Constant	0.?9? [1.60]	1.11? [1.4?]	0.848 [2.19]	1.11? [4.0?]	46.99 [6.38]	73.59 [6.78]	-0.0769 [1.1?]	-0.0??1 [1.2?]
$\bar{R}^2$	.46	.48	.42	.21	.52	.60	.64	.63
D.W.	.88	.89	.82	1.26	.84	1.22	.79	.83

* $\dot{X}$ is substituted for ΔX

levels in Canada generally, the relationship between wages in the industry in Canada and in the same industry in the United States, the profitability of the industry, and the demand for labour in the industry based upon the demand for the output of the industry. From Chapter II it is evident that all of these factors may be expected to have some influence on wages in every industry. However, the importance of these factors is likely to vary from industry to industry.

Our principal concern is to ascertain whether there is a high probability that variations in the postulated determinants of wages are related to variations in wage changes without worrying too much about the size of the relationship between the explanatory variables and wage changes. Evidence on the influence of any explanatory variable on wage changes in a particular industry, in this limited sense, is provided by the calculated statistical significance of the estimated coefficients for each exploratory variable.

Table III.4 presents a summary of this evidence based on the quarterly estimates shown in Table III.3 as well as on other quarterly estimates. This summary is necessarily somewhat subjective in a number of cases. Estimated coefficients with signs that are incorrect, according to the a priori specification indicated earlier, are designated as insignificant in Table III.4.

Proceeding on this basis what can we say about the influence on wage changes in various industries of each of the explanatory variables included in our estimates? The variable that shows through most strongly is relative wages, W_i/W_T. There is fairly strong evidence of a significant association within the range of experience examined between variations in W_i/W_T and wage changes in the rubber, textiles, clothing, paper, printing, electrical apparatus, non-ferrous metals and non-metallic mineral industries.

TABLE III.4

SUMMARY OF THE EVIDENCE INDICATING A STATISTICALLY SIGNIFICANT ASSOCIATION BETWEEN WAGE CHANGES AND THE EXPLANATORY VARIABLES INCLUDED IN THE WAGE-CHANGE RELATIONSHIPS, QUARTERLY ESTIMATES, 1952-1966

	Wage Relative to Canadian Wages	Unemployment	Labour Demand	Wage Relative to United States Wages	Profits
Food and Beverages	*	X	?	?	*
Rubber	X	X	*	?	?
Textiles	X	X	?	?	?
Clothing	X	X	?	?	?
Paper	X	?	?	X	?
Printing	X	*	X	?	?
Iron and Steel	?	?	X	?	?
Transportation Equipment	?	?	X	*	X
Electrical Apparatus	X	X	?	X	X
Non-Ferrous Metals	X	?	X	?	X
Chemicals	?	?	X	X	?
Non-metallic Minerals	X	X	X	?	?

X significant association indicated.

* marginally significant association indicated.

? no significant association.

The evidence of such an association is weaker in the food and beverage industry. And there is little or no evidence of a significant association in the transportation equipment, iron and steel and chemicals industries where the estimated coefficients either have the wrong sign or are insignificant or both.

The level of unemployment also seems to be strongly associated with wage changes. There is quite a significant association between the level of unemployment and wage changes in the food and beverage, rubber, textiles, clothing, paper, electrical apparatus and non-metallic minerals industries. A less significant association is indicated for printing, chemicals and iron and steel and there is no evidence of a significant association in the transportation equipment and non-ferrous metals industries.

Labour demand as measured in this study shows up as a significant determinant of wage changes in six industries and as marginally significant in two more. Those industries for which a fairly strong association is apparent are printing, iron and steel, transportation equipment, non-ferrous metals, chemicals and non-metallic minerals. A weaker association is evident in the clothing and rubber industries. The estimates fail to indicate a significant association in the food and beverage, textile, paper and electrical apparatus industries. In this connection it should be noted that sorting out the partial influence of unemployment and labour demand is made difficult because of multicallinearity between these variables. Because of this, the calculated standard errors for the estimated coefficients are raised. As a consequence, if one follows the procedure adopted here, these two variables tend to cancel each other out and they probably show up as less significant than they actually are.

For three industries, according to Table III.4, the level of wages relative to United States wages in the same industry, W_i/W_{us_i}, is significantly related to wage changes: the paper, electrical apparatus and chemicals industries. A weaker association is indicated in the transportation equipment industry. In the food and beverages, textiles, clothing, iron and steel, non-ferrous metals, rubber, printing and non-metallic minerals industries there is either no evidence of a significant association or the estimated coefficient has the wrong sign.

Finally there is the profits variable. In the majority of industries no significant relationship was found between $\pi_{i_{-2}}$ and the change in wages. A fairly significant relationship was found in three industries: transportation equipment, electrical apparatus and non-ferrous metals; and a relationship of more doubtful significance is evident for the food and beverage industry.

In order to evaluate the importance of various factors affecting wage changes more precisely, the analysis should be based on four-digit industry classifications. At the two-digit level one is still dealing with large sub-aggregates that are highly heterogeneous in most cases. And whether the analysis is undertaken at the four- or two-digit level, it is evident that substantially better data are required particularly on wages and profits, before one can hope to measure the magnitude of the influence of the explanatory variables on wage changes with any degree of precision. 7/ This is not to suggest, of course, that inadequate data are necessarily entirely to blame for the inadequacies of the foregoing estimates; an alternative source of difficulties may be the theoretical specification of the model.

4. Supplementary Evidence

In addition to the series of estimates made on the basis of the model developed in Chapter II, another series of experiments was run which can perhaps best be characterized as a search procedure designed to illuminate further the factors influencing the level and the rate of change in wages in two digit industries. These experiments were not systematically related to a theoretical model such as the estimates presented in the previous section. In general these supplementary tests took one of several forms which may be summarized as follows: 8/

$$(III.3) \qquad \dot{X}_i = f_1 \; (U^{*-2}, \; \dot{X}_T^* \; \pi^*_{i_{-2}} \; \dot{W}^*_{us_i}, \; \dot{X}_{i_{-1}})$$

$$(III.4) \qquad \dot{W}_i = f_2 \; (U^{-2}, \; \dot{W}_T, \; \pi_{i_{-2}}, \; \dot{W}_{us_i}, \; \dot{W}_{i_{-1}})$$

$$(III.5) \qquad X_i = f_3 \; (U^{*-2}, \; X^*_T, \; \pi^*_{i_{-2}}, \; W^*_{us_i})$$

Simple linear relations were fitted by ordinary least squares to quarterly data from 1953 to 1966. In some of the estimates MH^*, or e were added to the relationship. As is to be expected, the value of $\bar{R}^2$ for estimates based on equation (III.5) is substantially higher than for estimates based on equations (III.3) and (III.4) or on equation (II.21), all of which include the dependent variable in the form of first differences.

Little will be made of these supplementary tests both because of the weak theoretical rationale underlying the tests and because they add little to the evidence already presented. Several points may be noted however.
1. Most of the tests based on equations (III.3), (III.4) and (III.5) indicate quite a significant association between unemployment and the relevant

wage variable. If anything the evidence of a significant association based on these tests is somewhat stronger than suggested by Table III.4. In the transportation equipment industry for which a perverse association was found according to Table III.3, a significant association with the expected sign is suggested by some of these other tests. These supplementary tests also suggest that unemployment levels may be significantly related to wage changes in the transportation equipment and non-ferrous metals industries.

2. As for the influence of the level or changes in the level of wages in manufacturing generally on wages in particular industries, the supplementary tests also suggest a significant relationship between this variable and wage changes in most industries. Some of this evidence indicates a significant association between wage changes and $\dot{X}_T$ or $\dot{W}_T$ in both the industries—transportation equipment and chemicals—for which no significant relationship is indicated in Table III.4.

3. The significance of the influence of United States wages or wage changes comes through less clearly from these supplementary tests than from the primary estimates summarized in Table III.4. Moreover, in none of the cases where no significant relationship was established by the estimates shown in Table III.4 was a significant relationship indicated by these supplementary tests. On the other hand, these supplementary tests suggest that the influence of industry profits in Canada may be somewhat more significant in a number of industries—textiles, clothing, and iron and steel—than indicated by Table III.4.

4. It is important to recognize that the foregoing comments suggest only marginal adjustments in the picture indicated by Table III.4. In the main, the evidence gleaned from these supplementary estimates, is broadly consistent with the picture conveyed by the estimates based on equation (II.21);

and where differences occur it must be remembered that the evidence based
on these supplementary tests is much weaker than that presented earlier.

A further piece of supplementary evidence that may usefully be intro-
duced at this point is provided in a paper by G. R. Sparks and D. A.
Wilton. 9/ Combining time-series and cross-sectional data for a sample of
133 negotiated wage contracts, the authors attempted to explain CB, the
negotiated percentage increase in the basic hourly wage rate averaged over
the duration of each contract for the period 1951 to 1965. Thirteen indus-
tries are represented in their sample; these are mainly at the four-digit
level though some are at a rather higher degree of aggregation. One of
their best estimates is as follows:

$$(\text{III.6}) \quad CB = \underset{[1.49]}{3.79} + \underset{[3.82]}{14.19} \ U^{-1} + \underset{[4.54]}{.33} \ \pi \underset{[2.37]}{-.34\Delta U} + \underset{[3.51]}{1.65\Delta P}$$

$$+ \underset{[1.71]}{1.02S} + \underset{[1.20]}{.04g} - \underset{[3.00]}{.13B} - \underset{[3.25]}{4.78\Delta P/U} + \sum_{i} \alpha_i D_i$$

$$\overset{-2}{R} = .33$$

where U = unemployment rate expressed as a percentage, averaged over the
four quarters ending in the quarter in which the contract was
signed.

$\Delta U = U_t - U_{t-1}$

π = profits (including losses) as a percentage of assets, calculated
as a weighted average of the current and preceding year's
profits.

ΔP = change in the consumer price index averaged over four quarters
ending in the quarter in which the contract was signed.

S = 1 when a strike occurred; otherwise equal to 0.

g = average percentage change in the industry's output over two
years ending in the year the contract was signed.

B = current base wage rate at the time of the wage bargain divided
by a four-quarter average of average hourly earnings in manufac-
turing.

D_i = dummy variables associated with individual industries, the coefficients of which where highly significant at the 95 per cent confidence level for all industries except one.

α = estimated coefficients of D_i.

No attempt will be made to comment on this relationship in detail since it is more relevant to the aggregate relationship presented in Chapter II (equation II.1) than to the disaggregated estimates under consideration here. Several points warrant special attention, however, within the context of the present discussion.

First, it should be recognized that the profits variable, which is statistically significant in equation (III.6) is a different variable than the profits variable included in our estimates or in equation (II.1). Sparks and Wilton define profits as a per cent of assets, calculated from data given in annual editions of Taxation Statistics. In our tests and in equation (II.1) profits are defined as profits per unit of output obtained from the sources shown in the Appendix. The difference between the estimates shown in Table III.3 and the Sparks-Wilton estimates regarding the significance of the relationship between profits and wage changes indicates that the outcome may depend in large measure on how one defines the profits variable. Profits per unit of output as indicated by D.B.S. data, rather than profits per unit of capital invested as indicated by taxation data, have been used in the present study and in the study of the aggregative wage change relationship by Bodkin et al. because this is the only variable available on a quarterly basis and because it was considered a more reliable estimate of quarter-to-quarter changes in profits in manufacturing. Moreover, it may be argued that both employees and employers in their negotiations may give more attention to the difference between the price of factor

inputs per unit of output and the unit price of output—i.e., profits per unit of output—and to variations in this difference over time, than to the rate of return per unit of capital invested, valuing capital at its historical cost rather than at its replacement price. 10/

Second, the coefficients of both unemployment and the relative wage (B) are highly significant in equation (III.6). This is fully consistent with the evidence provided by our estimates.

Third, Sparks and Wilton do not include a variable to reflect wages in the corresponding industry in the United States and consequently their relationship sheds no light on the importance of this variable. They do, however, include a variable to represent the effect of strikes on wages. This variable falls short of being statistically significant at a 95 per cent confidence level and is also insignificant in all other estimates given in their paper. Since the ability to mount a strike presumably is some reflection of union power, this failure to uncover a significant association between this variable and wage changes may suggest that the ability of unions to regulate wage changes is questionable. 11/

In addition, it may be noted that Sparks and Wilton were unable to uncover a significant statistical relationship between industry concentration and wage changes.

There is finally the question of whether there is any relationship between the degree of unionization in an industry and the rate of change in wages. This is an extremely difficult question to answer and no attempt will be made to do so here. In addition to a host of conceptual difficulties, consideration of this question is further impaired in Canada by a lack

of reliable data. Table III.5 presents what is alleged to be the most reliable series available in Canada on unionization by industry. These figures have been correlated with the percentage rate of change in wages in each two-digit industry from 1961 to 1966. The simple correlation is .04, which is insignificant statistically and does not provide a basis for believing with any confidence that there is a relationship between the degree of unionization and the rate of change in wages. Moreover when one compares the figures given in Table III.5 with the summary given in Table III.4, there is only slight evidence of relationship between the degree of union strength and the variables included in equation (II.21) which one might particularly expect to reflect union power—i.e., profits and United States wages. Nevertheless, it is conceivable that the strong showing of these variables in the transportation equipment and non-ferrous metals industries may reflect the relatively high degree of unionization in these industries.

TABLE III.5

PERCENTAGE OF LABOUR FORCE BELONGING TO A TRADE UNION, BY INDUSTRY, AVERAGE 1961-66

Food and Beverages	59
Rubber	86
Textiles	71
Clothing	50
Paper	89
Printing	55
Iron and Steel	72
Transportation Equipment	86
Non-Ferrous Metals	82
Electrical Apparatus	74
Chemicals	59
Non-Metallic Minerals	78

Source:

Working Conditions in Canadian Industry, Economics and Research Branch, Department of Labour, Canada.

REFERENCES

1/ Charles L. Schultze and Joseph L. Tryon, "Prices and Wages", The Brooklings Quarterly Econometric Model of the United States, James S. Duesenberry, Gary Fromm, Lawrence R. Klein, Edwin Kuh, eds. (Chicago: Rand McNally & Co. 1965) Chapter 9.

2/ L. M. Koyck, Distributed Lags and Investment Analysis (Amsterdam: North Holland Publishing Company, 1954).

3/ Estimates were also made using values of $\hat{MH}_i$ derived from the TSLS estimates of equation (II.10). These estimates, however, were not much different from the estimates using values of $\hat{MH}_i$ derived from the TSLS estimates of equation (II.11) and are not presented.

4/ Unfortunately the inclusion of $(W_i/W_T)_{t-4}$ and $(W_i/W_{us_i})_{t-4}$ in equation (II.21) means that $W_{i_{t-4}}$ appears implicitly on both the right- and left-hand sides of the equation—whether the dependent variable is defined as ΔX_i or $\dot{X}_i$—and raises the possibility that the estimated relationships may be spurious. No satisfactory way was found around this possible difficulty.

5/ This point is made by Kuh, op. cit., p. 346.

6/ The low values of the Durbin-Watson statistic indicate serious auto-correlation in the error terms of a number of these equations. The value of $\bar{R}^2$ is also fairly low in many cases though this is not unexpected when the dependent variable is defined in the form of dif-ferences.

7/ The profits data are especially weak and as pointed out later the importance of this variable seems to depend partly on how it is defined. In addition, the analysis in principle should be based on wage rate data, adjusted for fringe benefits, rather than on average hourly earn-ings data.

8/ The notation in these equations follows that outlined earlier. The only new variable is

$$\dot{X}^*_{T_t} = \frac{1}{4} \sum_{j=0}^{3} \dot{W}_{T_{t-j}} \quad \text{where} \quad \dot{W}_{T_t} = \frac{W_{T_t} - W_{T_{t-4}}}{W_{T_{t-4}}} \cdot 100 \ .$$

Variables from which the asterisk is omitted have not been transformed by the running average procedure applied to variables marked with an asterisk. Equation (III.3) is somewhat similar in form to the model employed by McGuire and Rapping op. cit. .

9/ "Determinants of Negotiated Wage Increases: An Empirical Analysis" mimeographed, 1968.

10/ The profit variables employed here by Sparks and Wilton differ from the profit variable used by Wilson and Eckstein in the paper cited earlier. Wilson and Eckstein define profits as profits after tax plus depreciation as a ratio to stockholder's equity.

11/ A difficulty about measuring the effectiveness of strikes using the dummy variable technique is that there is a distinct possibility that the dummy variable may be reflecting some other characteristic of wage changes in these industries instead of strikes. Another difficulty is that this technique does not allow for wide variations in the characteristics of strikes—e.g., their duration and the success of strikes in closing down plants.

KEY INDUSTRIES AND KEY BARGAINS

It has long been recognized that changes in wages in particular
industries are interrelated. One way in which they are interrelated is
directly through the supply side of the market: a rise in industry j's
wages is likely to induce a rise in industry i's wages as industry i attempts
to keep its labourers from moving to industry j. This aspect of the inter-
relation among industry wages is reflected in equation (II.21) which assumes
that the supply of labour in industry i is a function of the relative wage,
W_i/W_T .

Another channel through which wages are interrelated is via demand.
Suppose wages rise in industry j, that industry j is an important industry
in the economy and that the elasticity of demand with respect to income for
the output of industry i is quite high. In this situation the rise in
industry j's wages is likely to stimulate significantly the output for
industry i which in turn will stimulate the demand for labour in industry i
and consequently will raise wages in industry i. In addition, industries i
and j may have direct input-output connections: industry i's output may be
an important input for industry j; hence a change in output in j inducing
higher wages in j can also be expected to increase output in i and may

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induce higher wages in i as well. Both these demand elements are allowed for in equation (II.21) which assumes that the demand for labour in industry i is related via man-hours to output in industry i along with other factors.

In the paper already cited, Eckstein and Wilson emphasize the importance of two ideas in relation to this picture. The first is that wage changes in a key group of industries, having certain common characteristics, set the pace which wages in other industries tend to follow. The second is the importance of analyzing wage changes over bargaining periods to take account of the bargaining cycle in key industries, rather than mechanically on an annual or quarterly basis. For purposes of analyzing wage changes they divide the manufacturing sector into key and non-key industries. They envisage a wage bargaining cycle for the set of key industries and a spill-over process whereby wage changes that occur in the key group are a primary determinant of wage changes in the non-key group. In their paper they present evidence to support this picture of the determination of money wages in American industry.

In order to proceed with this analysis it is necessary, first of all, to try to identify the key group of industries in some meaningful way. The next step is to consider what evidence there is, if any, of a bargaining cycle for this key group and, if possible to date the various phases of the cycle. The third step is to consider the interrelation between wage changes in the key group and the non-key group.

1. Key Industries

The concept of the "key group" is far from precise. Eckstein and Wilson characterize industries in the key group as "high-wage industries, [that]

have strong industrial unions, typically consist of large corporations that
possess considerable market power and are geographically centered in the
Midwestern industrial heartland of the continent". 1/ In statistical terms
the group is defined to include the following two-digit industries: rubber,
stone, clay and glass, primary metals, fabricated metals, non-electrical
machinery, electrical machinery, transportation equipment and instruments.
In a subsequent analysis Frank C. Ripley attempted to identify the key group
in a more precise manner. 2/ As Ripley observes, Eckstein and Wilson based
their definition of the key group on impressions gained from graphical anal-
ysis and discussions with labour economists. He attempts to determine
statistically what industry characteristics are relevant to defining the key
group. Employing the techniques of "discriminant" analysis and "principal
component" analysis, Ripley tries to identify the characteristics of key
industries.

Ripley's analysis suggests three main conclusions.

(a) "The time-series behaviour of profit rates in an industry is the
most important factor classifying the industry inside or outside the key
group; key industries have high and volatile profit rates in comparison with
industries outside the key group".

(b) Interactions among the key group industries are very important in
the wage determination process; hence aggregation of the key group is impor-
tant in explaining wage interaction. And the profit characteristics of the
key group indicate that the interaction among industries in wage bargaining
is a product market phenomenon.

(c) Considerable weight should be given to the influence of profits
on wage changes in the bargaining process.

In the analysis that follows an attempt has been made to duplicate Ripley's analysis for Canada. A major difficulty arises because of the lack of comparable data on profits. In both the Eckstein-Wilson and Ripley analyses profits are defined as profits after tax plus depreciation as a ratio to shareholders' equity. The variable used in the analysis in Chapter III is quite different: an index of profits per unit of output. While this latter variable may roughly reflect changes in the level of profitability over time, it cannot legitimately be used to compare the profitability of doing business in different industries on a cross-sectional basis. As a feasible alternative profits per unit of value added has been used as the profits variable in duplicating Ripley's tests for Canada.

In our analysis two definitions of the key group were employed. The first was to assume that the key group in Canada is the same as that defined for the United States by Eckstein and Wilson. On this basis, adjusting for some differences in the industrial classifications, the key group for Canada was defined as: rubber, iron and steel, transportation equipment, non-ferrous metals, electrical apparatus and non-metallic minerals.

The second approach was to define arbitrarily certain characteristics of key industries along the lines suggested by Eckstein and Wilson and then to classify as key industries those industries having these characteristics. The characteristics that were considered are as follows:

(a) Key industries might be expected to have a high degree of inter-dependence, making it unlikely that wage changes in a key industry deviate very much from wage changes in the group as a whole. The strong ties among these industries both in product and factor market would ensure very rapid transmission of wage changes throughout the group.

(b) Key industries might be expected to be characterized by strong trade unions tending to operate on a national or at least an interregional basis rather than on an intra-regional, firm or plant basis.

(c) In order for wage changes to have much influence outside the key group, both the level and the rate of change in wages in key industries might be expected to be higher than the level and rate of change in wages in non-key industries.

On this basis the key group was defined as follows: food and beverages, paper, printing, iron and steel, transportation equipment, non-ferrous metals and electrical apparatus.

Estimates on the degree of unionization have already been presented in Table III.5. As noted earlier these estimates are not very reliable. It is apparent that the correlation between these figures and our list of key industries is not very high. The reason is that the figures given in Table III.5 reflect unionization of all kinds. Chemicals and clothing were eliminated from the list of key industries partly because of the low degree of unionization in these industries—well below most other industries. However, rather than rely routinely on the estimates shown in Table III.5 for choosing other industries, it was decided to focus on industries that include strong unions operating on a fairly broad basis throughout the country. The choice of these unions is necessarily a matter of judgment and may be challenged. Nevertheless, some of the principal unions in question for each industry are shown in Table IV.1.

A further point might be noted in this connection. Although a high percentage of unionization may seem to be important, one would expect the absolute size of union membership to be significant also as far as

TABLE IV.1

SELECTED TRADE UNIONS IN KEY INDUSTRIES

Industry	Selected Trade Union
Food and Beverages	Bakery Workers; Brewery Workers; Distillery Workers; United Packinghouse Workers; Teamsters Union.
Paper Products	International Brotherhood of Pulp; Sulphite and Paper Mill Workers; Papermakers and Paperworkers; International Woodworkers of America.
Printing	Typographical Union; Printing Pressmen Newspaper Guild; Bookbinders.
Iron and Steel	United Steel Workers; International Association of Machinists; United Mine Workers; Metal Trades Federation; United Auto Workers.
Transportation Equipment	United Auto Workers; International Association of Machinists.
Non-Ferrous Metals	United Auto Workers; United Mine Workers; Metal Trades Federation; United Steel Workers; International Association of Machinists.
Electrical Apparatus	United Electrical Radio and Machine Workers; International Union of Electrical and Machine Workers.

identifying key industries is concerned. For example, although rubber and non-metallic mineral products have a high degree of unionization, the total number of union members in these industries is relatively small. In addition, one might exclude both textile and clothing industries because these industries employ a higher proportion of female workers who traditionally have been less militant.

No direct evidence has been found to indicate that bargaining is carried on on a national basis in any of the industries included in the key group. The data available on collective bargaining by type of agreement suggest that even in these industries most bargaining is done on a local basis. This is well illustrated in Chart IV.1 which shows (a) that agreements between a single union and single employer continue to dominate collective bargaining and (b) that there has been no significant shift towards more centralized types of bargaining. Moreover, as indicated by Chart IV.2, bargaining has tended to be carried on for relatively small units—a tendency which, if anything, has increased with time. Nevertheless, since there is some reason to believe that the industries shown in Table IV.1 include relatively strong unions, operating on an extensive basis across the country, one might assume that to the extent that they have any influence at all it will be broadly reflected in the various local agreements which are negotiated, even though each agreement may be conditioned by local circumstances as well.

It should also be recognized that the unions listed in Table IV.1 are by no means the only unions represented in these broad two-digit industry classifications. Each industry includes a multitude of unions. Moreover, the unions which have been listed in some cases are also active in industries which have not been included in our key group. Short of undertaking a

CHART IV.1*

COLLECTIVE BARGAINING BY TYPE OF AGREEMENT

(YEAR - BY - YEAR PERCENTAGE DISTRIBUTION
OF EMPLOYEES COVERED BY NEW AGREEMENTS)
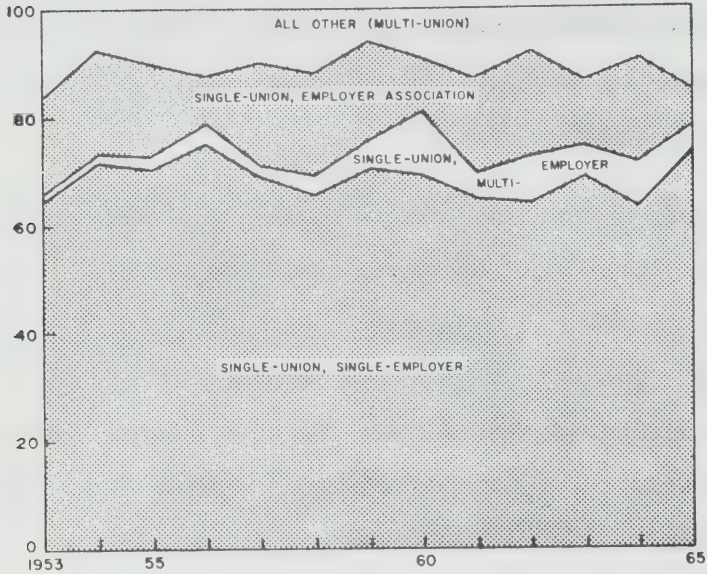
Note: Data relate to collective agreements covering 500 or more employees in all industries except construction and railways, and are weighted by numbers of employees covered in each agreement. Data for each year relate only to agreements signed in that year.

Source: Based on data from Department of Labour and Economic Council of Canada.

CHART IV.2*

COLLECTIVE BARGAINING:
AVERAGE NUMBER OF EMPLOYEES PER NEGOTIATION
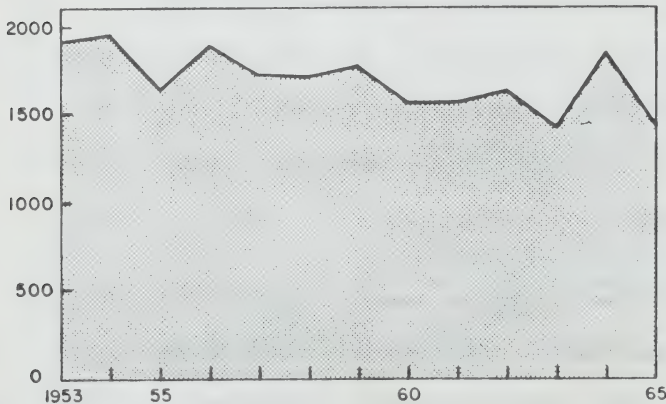
Source: Based on data from Department of Labour and estimates by the Economic Council of Canada.

*from Third Annual Review E.C.C., 1966, pp. 29, 130.

full-blown study of each union and its relationship to each industry, the
only way of proceeding was to make some arbitrary judgments about the rel-
ative strength of unions and their relationships with various industries.
The organization and strength of various unions among different industries
and, indeed, among different firms pose complex and difficult questions
about which comparatively little seems to be known except on an ad hoc basis.
This consideration represents a major qualification not only for this partic-
ular analysis but also for any analysis using the key industry approach.

As far as interdependence among industries is concerned, it was assumed
that there is a high degree of interdependence among the following indus-
tries: iron and steel, transportation equipment, non-ferrous metals and
electrical apparatus. Similarly, one might expect a fairly high interdepen-
dence between paper products and printing.

Much more precise information is available regarding the level and
average rate of change in wages in various industries. These data for each
industry are shown in Table IV.2. Given the relatively low level and rel-
atively slow rate of increase in wages in the rubber, textile and clothing
industries, it seemed safe to eliminate these industries from consideration
as candidates for any pace-setting key group. The same can probably be said
for non-metallic minerals; as shown in Table IV.2, the level of wages in
this industry in 1953 was less than the average for all manufacturing. On
the basis of this consideration and the small number of union members in
this industry, referred to earlier, this industry was also excluded from
the key group.

Two additional sets of calculations were made relating to the key group.
The first was designed to compare inter-industry variations in the rate of
change in wages on a cross-sectional basis with variations in the rate of

TABLE IV.2

LEVEL OF WAGES IN CANADA, 1953, AND MEAN ANNUAL RATE OF INCREASE IN WAGES, 1953-65, BY INDUSTRY

Industry	Average hourly earnings in 1953	Mean rate of change in average hourly earnings, 1953-1966
	$	%
Food and Beverages	1.16	5.2
Rubber Products	1.43	4.8
Textiles	1.08	4.7
Clothing	.96	4.3
Paper Products	1.52	5.8
Printing	1.59	5.5
Iron and Steel	1.53	5.1
Transportation Equipment	1.57	5.4
Non-ferrous Metals	1.53	5.0
Electrical Apparatus	1.44	5.5
Non-metallic Minerals	1.36	5.5
Chemical Products	1.38	5.9
Average (simple)	1.38	5.2

change in wages over time. One might argue that if in fact key industries
play the role ascribed to them and if there is a cycle in the bargaining
process, one would expect inter-industry variations in the rate of change
in wages to be less than inter-temporal variations. In order to apply this
test two standard deviations were calculated using both Canadian and United
States data: (a) the standard deviation of the rate of change in wages rel-
ative to the unweighted mean of the rate of change in wages over time for
all industries; and (b) the standard deviation of the rate of change in
wages in each industry relative to the mean rate of change in wages from
1953-65. 3/ In both cases a simple arithmetic mean rather than a weighted
mean was employed. Although this procedure is open to some question, it
was adopted mainly in order to avoid suppressing the influence that rel-
atively small industries may have.

The standard deviation of wage changes among Canadian industries was
higher than the standard deviation of wage changes over time: 1.38 versus
0.42. On this test, it is doubtful whether there is as much similarity
among wage settlements in Canada as the key industry approach suggests.
Moreover, when the same calculations were made for the United States the
same general result was obtained. For the United States the standard devia-
tion among industries was 1.35 compared with a standard deviation of 0.46
over time.

In the second set of calculations an attempt was made to evaluate the
degree of similarity in the rate of change in wages among key industries.
For this purpose the square of the deviations of each industry's wage change
from an average rate of change in wages was calculated, normalizing for the
number of observations. This statistic, which here will be referred to as

a "D statistic", may be written formally as follows:

$$D_i = \sum_{t=1}^{n} \frac{\left(\dot{W}_{i_t} - \overline{\dot{W}}_t \right)^2}{n}$$

Where t = 1 to n.

$\dot{W}$ = annual percentage rate of change in average hourly earnings in the ith industry.

$\overline{\dot{W}}$ = average percentage rate of change in average hourly earnings in a group defined in one of the following ways:

α = simple average for all manufacturing

β = simple average for key industries as defined by Eckstein and Wilson

γ = simple average for key industries as defined in this study.

For purposes of comparison, this calculation was made for both Canada and the United States. The estimated D statistics are given in Table IV.3.

Several points are indicated by these figures. First, when calculated in relation to the mean for all industries, the value of D for Canadian industries is generally greater than for the corresponding United States industry. Clothing is the only exception. This may indicate that there is more similarity among wage changes in the United States than in Canada. Secondly, irrespective of which definition of the key group is employed as the basis for the calculation, the similarity of wage changes among key industries is not very apparent for either Canada or the United States. 4/ Thirdly, the difference in the D statistic between key and non-key industries is greater for the United States than for Canada.

The discriminant and principal component analysis undertaken on annual data for Canada follows the same approach as Ripley followed in his study.

TABLE IV.3

ESTIMATED D STATISTICS

	α (all industries)		β (Eckstein-Wilson key group)		γ (Key group, this study)
	Can.	U.S.	Can.	U.S.	Can.
Food and Beverages	1.65	1.08	(1.66)	(1.01)	1.65
Rubber	2.41	1.77	2.39	1.83	(2.43)
Textiles	2.65	1.32	(2.60)	(1.34)	(2.08)
Clothing	1.30	2.44	(1.28)	(2.52)	(1.31)
Paper Products	2.53	0.95	(2.59)	(0.90)	2.49
Printing	0.43	0.32	(0.46)	(0.37)	0.41
Iron and Steel	1.55	0.91	1.56	0.91	1.55
Transportation Equipment	1.77	0.81	1.80	0.78	1.76
Non-ferrous Metals	1.93	0.54	1.92	0.54	1.93
Electrical Apparatus	2.17	1.12	2.09	1.14	2.22
Non-Metallic Minerals	1.25	1.03	1.29	1.02	(1.23)
Chemicals	2.07	1.26	(2.14)	(1.21)	(2.04)
Average:					
Key Group)	1.81	1.13	1.84	1.04	1.72
Non-key Group)			(1.79)	1.23	(1.94)

Parentheses identify non-key industries.

$\dot{W}_i$ and $\dot{W}_{us_i}$ have been defined in Chapter II. P/V_i is equal to corporate
profits in industry i divided by value-added in industry i and PD is equal
to the annual percentage change in output per man-hour. For each of these
four variables discriminant functions were estimated taking into account two
characteristics: the mean and the variance. Functions taking into account
the means and variances for all four variables taken together were also
estimated. These functions are shown in Table IV.4. It is evident that
none of the functions is statistically significant irrespective of which
definition of the key group is assumed. The discriminant functions taking
the four variables together are also not significant for either definition.
On this showing, these definitions of the key group fail to distinguish in
a statistically significant manner between industries included in the key
group and those that are not included.

The value of the discriminant function for each of the component indus-
tries in the key and non-key groups is shown in Table IV.5. Based on these
values it is not possible to justify the two definitions since many indus-
tries are misclassified under both definitions.

Evidence based on principal component analysis is presented in Table
IV.6. In principle the key group classification should comprise only those
industries that have larger or smaller weights in the principal components
formed from the twelve industries being examined. Only the first principal
components were calculated. The purpose of the claculation is to find a
group of industries that exhibit the same characteristics. This method has
the desirable feature of not requiring an a priori definition of the key
and non-key groups. At the same time, it may be used to test the validity
of any a priori grouping that has been made. 5/ It is evident from

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TABLE IV.4

DISCRIMINANT FUNCTIONS BASED ON THE TWO DEFINITIONS OF THE KEY GROUP

Variable	Definition, this Study			Eckstein-Wilson Definition		
	Discriminant Function	R^2	F^*	Discriminant Function	R^2	F^*
$\dot{W}_{us}$	$0.1834\ X_1 - 0.0065\ X_2$	0.26	1.57	$0.0528\ X_1 + 0.0184\ X_2$	0.06	0.25
$\dot{W}$	$0.0763\ X_1 + 0.1268\ X_2$	0.02	0.11	$-0.1066\ X_1 - 0.1263\ X_2$	0.30	1.95
P/V	$0.2314\ X_1 + 0.1223\ X_2$	0.06	0.28	$-1.1728\ X_1 + 1.5034\ X_2$	0.30	1.97
PD	$-0.0193\ X_1 + 0.000348\ X_2$	0.02	0.10	$-0.0311\ X_1 + 0.0044\ X_2$	0.21	1.18
(means)	$0.1369\ \dot{W}_{us} - .0623\ \dot{W} + .3041\ P/V - .0020\ PD$	0.25	0.58	$0.0418\ \dot{W}_{us} + 0.378\ \dot{W} + .3037\ P/V - .0177\ PD$ $R^2 = .02$ $F = 0.04$		
(variances)	$-0.0126\ \dot{W}_{us} + .0219\ \dot{W} + .5325\ P/V - .0033\ PD$	0.16	0.33	$0.0178\ \dot{W}_{us} - .0144\ \dot{W} + .2325\ P/V + .0023\ PD$ $R^2 = .41$ $F = 0.84$		

* The critical value of F for $(2,9)$ degrees of freedom at the 95 per cent confidence level is 4.26.

X_1 = mean

X_2 = variance

TABLE IV.5

VALUES OF THE DISCRIMINANT FUNCTIONS
BASED ON THE TWO DEFINITIONS OF THE KEY GROUP

Definition, this Study

	$\dot{W}_{is}$	$\dot{W}$	P/V	PD
Key Group				
Key Group	.6623	.3504	.0585	-.0549
Food & Beverages	.7392	.3316	.0340	-.0352
Paper	.7116	.3707	.0661	-.0488
Printing	.5761	.3755	.0257	-.0440
Iron & Steel	.6427	.3280	.1802	-.0655
Transportation Equip.	.0974	.3427	.0494	-.0857
Non-ferrous Metals	.6769	.3255	.0290	-.0428
Electrical Apparatus	.5950	.2830	.0257	-.0636
Non-Key Group				
Non-Key Group	.5759	.3280	.0383	-.0625
Rubber	.5480	.3225	.0454	-.0180
Textiles	.4970	.3107	.0434	-.1104
Clothing	.4655	.5011	.0181	-.0459
Non-metallic Minerals	.6511	.5591	.0405	-.0342
Chemicals	.7113	.5651	.0433	-.1041
Over-all	.6265	.5529	.0501	-.0581

Eckstein-Wilson's Definition

	$\dot{W}_{us}$	$\dot{W}$	P/V	PD
Key Group				
Key Group	.2250	-.6598	.0019	.0272
Rubber	.1928	-.7300	.0275	.0952
Iron & Steel	.2051	-.6409	.1698	.0808
Transportation Equip.	.2160	-.6830	-.0205	.0288
Non-ferrous Metals	.3302	-.7613	.0772	-.0461
Electrical Apparatus	.1953	-.6097	-.0783	.0070
Non-metallic Minerals	.2099	-.6142	-.1644	-.0021
Non-Key Group				
Non-Key Group	.2078	-.7606	-.1002	-.0421
Food & Beverages	.2293	-.6573	-.1554	-.0386
Textiles	.2037	-.7296	-.0474	-.1292
Clothing	.1916	-.6927	-.0347	.1248
Paper	.2218	-.7913	-.1442	-.0710
Printing	.1707	-.9638	-.1077	-.0304
Chemicals	.2283	-.7291	-.1102	-.1081
Over-all	.2164	-.7102	-.0489	-.0074

TABLE IV.6

COEFFICIENTS OF DIFFERENT INDUSTRIES IN THE FIRST PRINCIPAL COMPONENT

Definition, this Study

	$\dot{W}_{us}$	$\dot{W}$	P/V	PD
Key Group				
Food & Beverages	.1346	.1423	-.2072	.2515
Paper	.1319	.1109	.2036	.0851
Printing	.0917	.0978	-.1910	.1629
Iron & Steel	.1383	.1331	.0806	.2005
Transportation Equip.	.0947	.0649	.1358	-.0647
Non-ferrous Metals	.1209	.1161	-.1357	-.0492
Electrical Apparatus	.1208	.1428	.0091	.1923
Non-Key Group				
Rubber	.1046	.1340	-.0209	.1823
Textiles	.0226	.0806	.1550	.0550
Clothing	.0249	.1029	.2229	.0216
Non-metallic Minerals	.1336	.1492	.0716	.1962
Chemicals	.1330	.0858	-.1323	.1526
Percentage of total variation explained by the first principal component.	56	51	32	30

Eckstein-Wilson's Definition

	$\dot{W}_{us}$	$\dot{W}$	P/V	PD
Key Group				
Rubber	.1046	.1340	-.0209	.1823
Iron & Steel	.1383	.1331	.0806	.2005
Transportation Equip.	.0947	.0649	.1358	-.0647
Non-ferrous Metals	.1209	.1161	-.1357	-.0492
Electrical Apparatus	.1208	.1428	.0091	.1923
Non-metallic Minerals	.1336	.1492	.0716	.1962
Non-Key Group				
Food & Beverages	.1346	.1423	-.2072	.2515
Textiles	.0226	.0806	.1550	.0550
Clothing	.0249	.1029	.2229	.0216
Paper	.1319	.1109	.2036	.0851
Printing	.0917	.0978	-.1910	.1629
Chemicals	.1330	.0858	-.1323	.1526
	56	51	32	30

Table IV.6 that under neither definition of the key group are the weights

for industries included in the key group distinctly different from those

excluded. 6/

On the basis of this variety of evidence, it is questionable whether

either definition of the key group identifies a group of industries where

the pattern of wage change is much the same and significantly different from

the remainder of the manufacturing sector.

2.   Wage Rounds

In addition to emphasizing key industries and key bargains, the thesis

under consideration emphasizes that contractual wage agreements are nego-

tiated in a series of wage rounds. The evidence to support this view is

largely provided by H.M. Levinson and is summarized by Eckstein and Wilson

as follows:

> ---Chronologies of contract settlements show a clustering of
> settlements in time, and, in the case of key industries, also
> in the characteristics of the settlements. These rounds have
> ranged from one to four years. Once the pattern of the round
> is set in early key bargains, the movements of wages in the
> remaining months or years are largely determined until the
> next round is settled. Thus, to take the most extreme example,
> the wage settlements of 1955 and 1956 determined the bulk of
> the wage movements in the key industries up to 1958. The
> wages in this four year period were determined largely by the
> economic conditions in 1955 and 1956, not by the recession of
> 1958,--- 7/

This view of the evidence has been disputed. After examining data on

wage settlements from June 1955 to September 1958, E. Kuh concluded that

the evidence "simply did not reveal any clearly defined patterns to enable

the separation of one period from another with little ambiguity". 8/

Such evidence as we have for Canada relating to this question has recently been developed by the Department of Labour and has been partially summarized in the Third Annual Review of the Economic Council of Canada. 9/ Chart IV.3, taken from the Council's Report, provides little or no evidence to support the notion of wage rounds. As the Council points out, the figures underlying Chart IV.3 include only base rate wages and do not reflect changes in non-base-rate wages, hours of work and fringe benefits. Subject to this important qualification, the Council concludes that base-rate wage increases "under collective agreements have shown a high degree of sensitivity to general economic conditions". 10/ It goes on to note that the large settlements in the public sector played a prominent role in the evolution of bargaining in 1965 and 1966 when the rate of increase in base rates reached a peak. The Council states further that "normally, bargaining in Canada is not characterized by strong national pattern-setting". 11/

For purposes of this study it has not been possible to go much beyond the work done by the Council. Although a mass of data is now available on this subject from the Department of Labour, it proved very difficult to marshall this data effectively in order to clarify the question of wage-rounds beyond the work that the Economic Council did. Moreover, since this is at least partly the task undertaken in a companion study by Mr. Alton Craig, it was considered inappropriate to embark on an extensive analysis of this question which would necessarily tend to duplicate work. Nevertheless, some graphical analysis was done on the question. On this basis no evidence at all could be discerned of an identifiable bargaining cycle.

A further round of tests was also undertaken which bears on the validity of the twin notions of a bargaining cycle and key industries. In this set

of tests a matrix of simple correlation coefficients was estimated for the
rate of change in average hourly earnings in alternative pairs of industries.
These coefficients are given in Table IV.7. It is difficult to perceive a
pattern in these coefficients suggesting a key group of pace-seting indus-
tries that coincides with either of the two key groups suggested earlier.

CHART IV.3*

AVERAGE ANNUAL PERCENTAGE CHANGES IN BASE RATE WAGES
OVER LIFE OF COLLECTIVE AGREEMENTS
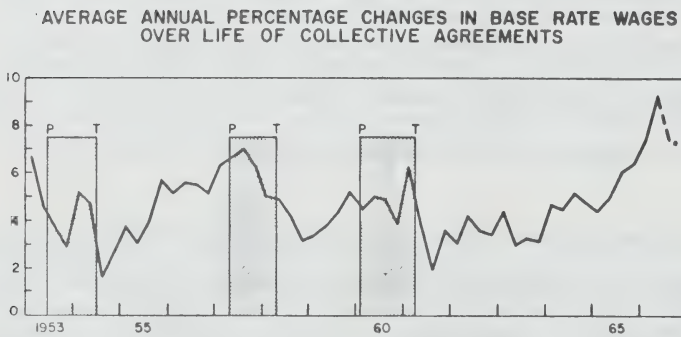
*Figure for third quarter of 1966 is a preliminary estimate.

The shaded areas denote recessions, and the letters P and T denote peaks and troughs in the
short term Canadian business cycle.

Source: Based on data from Department of Labour and estimates by Economic Council of Canada.

*from Third Annual Review, E.C.C., 1966, p. 132.

TABLE IV.I

MATRIX OF CORRELATION COEFFICIENTS, r(x, y)

(Annual Percentage Change in Average
Hourly Earnings, by Industry, 1953-66)

	Rubber Prods.	Tex-tiles	Cloth-ing	Paper Prod.	Print-ing	Iron and Steel	Trans. Equip.	Non-ferrous Metals	Elec. Appa.	Non-Met. Min-erals	Chem. Prods.
Food & Beverages	.6699*	.2991	.3570	.3997	.7135*	.9129*	.5303*	.6312*	.7186*	.6749*	.4204
Rubber Products		.5505*	.6303*	.5441*	.4860*	.6859*	.3323	.2706	.6969*	.7392*	.2801
Textiles			.7373*	.1385	-.0044	.1724	.2560	.2660	.3561	.5931*	-.0169
Clothing				.3868	.1116	.2530	.4838*	.1954	.6089*	.7576*	-.0702*
Paper Products					.2795	.3871	-.1984	.5452*	.6849*	.7836*	.5425*
Printing						.6785*	.3087	.3568	.4645	.3553	.2789
Iron and Steel							.5613*	.5914*	.5976*	.5706*	.4598
Trans. Equipment								.1070	.2242	.2516	-.2455
Non-ferrous Metals									.5925*	.6684*	.7606*
Elec. Apparatus										.8325*	.4731
Non-Met. Minerals											.4361

* Significant at 95 per cent level of confidence.

3. The Role of Key Groups

Having failed to define and to identify key industries and key bargains
with any degree of assurance and having also failed to find any creditable
evidence of a bargaining cycle, there is substantial doubt about two of the
assumptions underlying the Eckstein-Wilson hypothesis as far as its app-
licability to Canada is concerned. Consequently, one may question the use-
fulness of proceeding to the next step which is to test whether there is any
evidence that wage changes in the key group have influenced wage changes out-
side the key group. This has been done, nevertheless. One might argue that
while the evidence that has been presented does not provide any evidence for
the existence of a key group and a bargaining cycle, neither does it provide
strong evidence for the non-existence of a key group and a bargaining cycle.
It is recognized, of course, that in order to substantiate the hypothesis
for Canada it is more important to be able to substantiate the existence of
a key group and a bargaining cycle than their non-existence.

In testing empirically for the influence of key-industry wage changes
on other industries the following procedure was followed:

(a) Dummy variables intended to identify wage rounds were added to
equation (II.21) and the equation was refitted for various industries. The
Eckstein-Wilson dates were used to identify the bargaining cycle up to 1960.
For the period after 1960 two additional cycles were identified on the basis
of subjective impressions gained by looking at the rate of change in average
hourly earnings in United States manufacturing industries. 12/ The dummy
variables and the associated dates used are as follows:

D_2 = 1 January 1955 to December 1958; otherwise = 0

D_3 = 1 January 1959 to December 1960; otherwise = o

D_4 = 1 January 1961 to December 1963; otherwise = o

D_5 = 1 January 1964 to December 1966; otherwise = o.

The objective of this test was to ascertain whether there was a statistically significant relationship between the assumed wage rounds for key-industry wages in the United States and Canadian wage changes. If one found that the estimated coefficients for the dummy variables were statistically significant, one might conclude that there is evidence of a bargaining cycle in Canada similar to the United States cycle and/or that Canadian wages are significantly related to the bargaining cycle for a key group of industries in the United States.

(b) As an alternative to assuming that the key group can be identified on an industry basis, it was assumed that the key group is identified by employees covered by collective agreements and that the wage changes of employees not covered by collective agreements follow the change in wages of those who are covered by such agreements. In order to test this proposition satisfactorily one should have separate data on wage changes for both groups of employees—data which unfortunately are not available. The only data that are available show the average percentage change in base rates over the life of a sample of 133 collective agreements for negotiating units of 500 or more employees completed in any given quarter. 13/ This sample includes 88 agreements in the manufacturing sector and 45 agreements in the primary and service sectors. In total it covers about 225,000 employees, of whom about 146,000 are employed in manufacturing industries. Within each industry the sample covers only a small porportion of the total number employed, the maximum occurring in wood products where the sample covers 8 per cent of the total number of employees.

On the assumption that the key group is identified by this sample of employees covered by collective agreements, equation (II.21) was rerun for each industry including an additional variable CB_t^* defined as follows:

$$CB_t^* = \frac{1}{4} \sum_{j=0}^{3} CB_{t-j} \qquad \text{where } CB_t \text{ is the average annual percentage}$$

change in base rate wage rates over the life of the collective agreements for all negotiating units included in the sample completed in quarter t.

One difficulty with this procedure is that CB is expressed in percentage terms whereas equation (II.21) is intended to explain absolute wage changes. Unfortunately, the data available on collective agreements show only percentage wage changes. 14/

Another and possibly more serious difficulty arises because of the lack of any data on wages not covered by collective agreements. Hence, average hourly earnings as defined in Chapter III incorporate the wage changes covered by collective agreements as well as those not so covered with the result that the wage changes of those covered by collective agreements appear on both sides of the equation. How serious this problem is is impossible to tell. Two considerations suggest that it may be less important than one might assume at first glance. First, a high proportion of the agreements and employees included in the sample of collective agreements are outside the manufacturing sector whereas average hourly earnings as defined in Chapter III relates to manufacturing only. Secondly, equation (II.21) is fitted to individual two-digit industries. This means that the collective agreements reflected in average hourly earnings for a particular industry are a small proportion of the total number of collective agreements on which CB* is based and the intercorrelation between changes in average hourly earnings in that industry and CB* may be quite small.

A lag was built into the form of CB* by taking a four-quarter moving average, which is similar to the procedure used in connection with several other variables as described in Chapter III. In addition, a discrete lag of two quarters was imposed on CB* so that it entered the equation as CB^*_{-2}. This procedure was intended to allow for a larger lag in the adjustment of wages in other sectors to wage changes in this key sector. It also has the added advantage of further reducing the direct link between CB* and the dependent variable, referred to earlier.

(c) The average (unweighted) percentage change in wages for the key industry group, $\overline{\dot{W}}^*$, defined in one of two ways, was substituted for $\dot{X}^*_T$ as an explanatory variable in the estimated regression equations fitted to equations (III.3) and (III.5).

(d) Simple regression equations of the following form were fitted to both quarterly and annual data for each industry using three different wage change variables and comparing the t—ratios associated with the estimated value of b :

(IV.1) $\dot{X}^*_i = a + b$ (wage change variable)

where the wage change variable is defined in one of three ways.

$\dot{X}^*_T$, as defined earlier

$$\overline{\dot{W}}^*_k = \frac{1}{4} \sum_{j=0}^{3} \overline{\dot{W}}_{k_{t-j}} \quad \text{where} \quad \overline{\dot{W}}_k = \left(\frac{\overline{W}_{k_t} - \overline{W}_{k_{t-4}}}{\overline{W}_{k_{t-4}}} \right) \cdot 100$$

and $\overline{\dot{W}}_k$ is the average (unweighted) percentage change in average hourly earnings in the key group as defined in this study;

$$\bar{\dot{W}}^{*}_{1} = \frac{1}{4} \sum_{j=0}^{3} \bar{\dot{W}}_{1_{t-j}} \quad \text{where} \quad \bar{\dot{W}}_{1} = \left(\frac{\bar{W}_{1_{t}} - \bar{W}_{1_{t-4}}}{\bar{W}_{1_{t-4}}} \right) \cdot 100$$

and $\bar{\dot{W}}_{1}$ is the average (unweighted) percentage change in average hourly earnings in the key group as defined by Eckstein and Wilson.

This procedure is subject to several qualifications some of which may be briefly noted. First, when applied to industries within the group, the procedure has a bias in favour of showing the key group wage change as a stronger determinent of wage changes in the industry than wage changes in all manufacturing. This is because wage changes within an industry are included in the key group wage change and have a greater influence on the key group average than in the average for all manufacturing. The reverse applies to non-key industries where the procedure is biased in favour of showing that key industry wage changes are less significant than wage changes generally. Secondly, our industrial classifications are so broad and the key group encompasses such a large segment of manufacturing that wage changes in this segment of manufacturing can scarcely be regarded as changes in a limited leading sector of the economy. In other words the intercorrelation between $\dot{X}^{*}_{T}$ or $\bar{\dot{W}}_{T}$, and $\bar{\dot{W}}_{K}$ and $\bar{\dot{W}}_{1}$ is necessarily high. Consequently, it is difficult to sort out the hypothesis at issue in a meaningful way.

The tests designed to test the influence of United States key-industry wage rounds by including appropriately defined dummy variables in equation (II.21) failed to establish the importance of this factor. In almost every instance the estimated coefficients for the dummy variables are statistically insignificant and in many cases the signs of the coefficients are wrong as

well. Inclusion of these dummy variables has some influence on the performance of other variables in the equation which is of some interest and may be noted. When the dummy variables are included, the influence of both W_i/W_T and $\hat{MH}$ is somewhat strengthened judging by the value of the estimated t—ratios. On the other hand the influence of W_i/W_{us_i} judged in terms of t—ratios, is reduced. This is perhaps not surprising since presumably there is high multicollinearity between W_{us_i} and the dummy variables which raises the estimated standard errors.

Leaving aside for the moment the tests based on a redefinition of the key group in terms of collective agreements and considering the third and fourth approaches outlined above, one can say that the substitution of either $\bar{\dot{W}}^*_K$ or $\bar{\dot{W}}^*_1$ for $\dot{X}^*_T$ in equations (III.1) and (III.3) failed to provide any evidence to support the key group hypothesis. The same is true of the tests based on estimates of equation (IV.1). Table IV.8 compares the t-ratios of the estimated coefficients for the three alternative wage change variables: wage changes in total manufacturing and wage changes in key industries using both definitions of the key group. Although this test is by no means con-clusive, it nevertheless fails to provide support for the view that wage changes in key industries bear a more highly significant relationship to changes in wages in Canadian manufacturing than wage changes generally in all manufacturing. In such non-key industries as textiles and clothing $\dot{X}^*_T$ and $\dot{W}_T$ are more significant than $\bar{\dot{W}}^*_K$ and $\bar{\dot{W}}^*_1$ and $\bar{\dot{W}}_K$ and $\bar{\dot{W}}_1$. This result is qualified because of the bias in the procedure already noted. But even when the bias is in the other direction $\dot{W}_T$ frequently is more significantly related to wage changes in a particular industry than key industry wage changes—e.g., electrical apparatus.

In all of these tests the key group has been defined on an industry basis. An alternative is to define it in terms of employees covered by collective agreement as outlined earlier. The estimates of equation (II.21) including $CB*_{-2}$ are shown in Table IV.9. These estimates include the values of $\hat{MH}_1$ derived from the TSLS linear estimates of the production function for each industry.

Judging on the basis of goodness of fit $(\bar{R}^2)$, one can say that with some exceptions the estimates given in Table IV.9 are somewhat better than the estimates presented in Table III.3. More interesting, however, is the evidence that variations in CB^*_{-2} are significantly related to variations in ΔX_i in seven industries and marginally in an eighth. Moreover, the inclusion of CB^*_{-2} in the estimated wage-change relationships has a considerable impact on the statistical significance of other explanatory variables, particularly U^{*-2} . Table IV.10 corresponds to Table III.4 presented earlier. Comparing these two tables one may conclude that the inclusion of CB^*_{-2} in the relationship appears to reduce greatly the statistical significance of the estimated parameters for U^{*-2} and also to reduce somewhat the significance of the parameters associated with $(W_i/W_T)_{-4}$. On the other hand, the pattern of significant relationships associated with labour demand and profits remains similar. The coefficients associated with $(W_i/W_{us_i})_{-4}$ become insignificant in all but one industry—the electrical industry.

Unfortunately this result is not as telling as it might appear because of the close relationship between CB^*_{-2} and U^{*-2} and $(W_i/W_T)_{-4}$ as well as for other reasons mentioned earlier. 15/ Because of this close relationship and the other limitations of the estimates, it is not possible to sort out very satisfactorily the separate influence of each variable separately on ΔX_1. Nonetheless, one can say that the evidence is not

TABLE IV.8

COMPARISONS OF THE t-RATIOS
OF THE ESTIMATES OF b IN EQUATION IV.1

	Quarterly			Annual		
	$\overset{\bullet}{X}{}^{*}_{T}$	$\overset{\bullet}{\overline{W}}{}^{*}_{K}$	$\overset{\bullet}{\overline{W}}{}^{*}_{1}$	$\overset{\bullet}{\overline{W}}_{T}$	$\overset{\bullet}{\overline{W}}_{K}$	$\overset{\bullet}{\overline{W}}_{1}$
Food and Beverages	8.34	8.00	6.96**	5.07	7.80	6.32**
Rubber	7.40	5.58**	7.33	4.72	3.17**	4.41
Textiles	7.48	5.01	5.80	2.14	1.02	1.71
Clothing	5.32	3.58	4.87	2.97	1.77	2.57
Paper	4.93	6.16	3.71**	2.81	2.59	2.31**
Printing	5.36	6.62	4.72**	2.05	2.84	2.23**
Iron and Steel	0.87	1.31**	1.57**	4.11	6.27**	5.52**
Transportation Equipment	1.31	1.03**	1.92**	1.46	1.68**	1.99**
Non-ferrous Metals	2.72	2.08**	2.40**	3.16	3.69**	3.02**
Electrical Apparatus	6.85	6.07**	6.68**	5.50	4.95**	5.14**
Chemicals	5.30	6.69	5.14	1.86	2.01	1.67
Non-Metallic Minerals	5.91	4.22	5.93	8.11	4.67**	5.67

** included in the key group

TABLE IV.9

ESTIMATED WAGE-CHANGE RELATIONSHIPS: TWO-DIGIT MANUFACTURING INDUSTRIES, QUARTERLY, 1953-66

Dependent Variable = ΔX_i

Explanatory Variables

	U^*_{-2}	CB^*_{-2}	$(W_i/W_T)_{-4}$	$(W_i/W_{us_i})_{-4}$	π^*_{i-2}	$\widehat{MH}_{i-2}$	Constant	$\bar{R}^2$	D.W.
Food and Beverages	0.0830 [0.66]	0.00922 [3.59]	-0.344 [1.44]	0.151 [0.57]	0.228 [1.83]	-0.0000110 [1.31]	0.161 [1.08]	.41	1.03
Rubber	0.401 [1.61]	0.0103 [2.67]	-1.103 [3.84]	0.00674 [0.04]	-0.598 [0.67]	0.0000347 [2.32]	0.996 [3.33]	.64	1.17
Textiles	0.187 [1.07]	0.0112 [4.98]	-0.232 [0.89]	0.461 [4.54]	0.0656 [0.42]	0.0000102 [0.54]	-0.257 [1.19]	.78	1.35
Clothing	0.365 [2.52]	0.000583 [0.20]	-0.566 [2.31]	0.294 [1.84]	0.0345 [0.21]	0.0000404 [1.53]	0.0325 [0.18]	.60	1.46
Paper	0.850 [2.58]	0.00758 [1.74]	-0.488 [2.29]	-0.541 [1.34]	-0.256 [2.65]	0.0000040 [0.17]	1.161 [2.88]	.69	1.01
Printing	0.0662 [0.49]	-0.000864 [0.27]	-0.761 [3.27]	0.317 [1.83]	-0.00138 [0.05]	0.0000459 [2.37]	0.543 [2.79]	.41	1.08
Iron and Steel	-1.053 [1.59]	-0.00433 [0.40]	-0.205 [0.31]	-0.472 [0.53]	-0.0164 [0.11]	0.000116 [2.65]	0.295 [1.46]	.01	.65
Transportation Equipment	-0.475 [1.40]	-0.00706 [1.10]	0.237 [0.64]	-0.724 [1.08]	0.167 [3.04]	0.0000426 [2.98]	0.0798 [0.33]	.20	1.51
Non-ferrous Metals	-0.602 [0.71]	0.0402 [2.18]	-1.856 [3.66]	0.243 [0.33]	0.0748 [0.44]	0.000141 [3.15]	1.073 [2.55]	.52	.92
Electrical Apparatus	0.564 [4.80]	0.00601 [2.25]	-0.490 [3.22]	-0.586 [2.80]	0.437 [2.32]	-0.00000615 [1.99]	0.979 [5.01]	.67	1.42
Non-metallic Minerals	0.241 [2.59]	0.0130 [6.68]	-0.323 [2.50]	0.487 [3.01]	0.0460 [0.15]	0.0000156 [4.39]	-0.158 [3.17]	.82	1.56
Chemicals	-0.388 [2.71]	0.0211 [6.35]	0.0608 [0.38]	-0.949 [1.85]	0.114 [2.06]	0.0000260 [1.35]	0.522 [2.36]	.58	1.59

TABLE IV.10

SUMMARY OF THE EVIDENCE INDICATING A STATISTICALLY SIGNIFICANT ASSOCIATION
BETWEEN WAGE CHANGES AND THE EXPLANATORY VARIABLES INCLUDED IN THE
EXPANDED WAGE-CHANGE RELATIONSHIPS, QUARTERLY ESTIMATES, 1953-1966

	Collective Bargaining Wage Change	Wage Relative to Canadian Wages	Labour Demand	Unemployment	Profits	Wage Relative to United States Wages
Food and Beverages	X	*	?	?	*	?
Rubber	X	X	X	*	?	?
Textiles	X	?	?	?	?	?
Clothing	?	X	*	X	?	?
Paper	*	X	?	X	?	?
Printing	?	X	X	?	?	?
Iron and Steel	?	?	X	?	?	?
Transportation Equipment	?	?	X	?	X	?
Electrical Apparatus	X	X	?	X	X	X
Non-Ferrous Metals	X	X	X	?	?	?
Chemicals	X	?	?	?	X	*
Non-Metallic Minerals	X	X	X	X	?	?

X   significant association indicated

*   marginally significant association indicated

?   no significant association.

inconsistent with the view that the collective bargaining units included in our sample have served as a pace-setting key group in the wage determination process and that bargains struck in this key group had spill-over effects on wage changes outside this key group.

In summary, our evidence suggests that to the extent that the key group hypothesis has any validity for Canada, the key groups seem to be collective bargaining units and, in one or two industries perhaps, the corresponding industry in the United States. 16/

An important problem for the key group—key bargain hypothesis is that it lacks a well-articulated theoretical foundation on the basis of which one may develop an empirical analysis. The mechanism whereby changes in the key group are transmitted to other sectors is unspecified. A series of hypothesis about price determination and market mechanisms are implied and until these are made explicit and tested, the major thesis necessarily remains in doubt. In addition, a variety of assumptions are implied about the monetary and financial sectors of the economy which also need to be examined. Finally, there is an element of circularity in first examining a range of data for the purpose of identifying key groups and bargaining cycles and then using the same data to demonstrate empirically that key groups and bargaining cycles exist and that these sectors lead wage changes in other sectors.

REFERENCES

1/ Otto **Eck**stein and Thomas A. Wilson (Ref. II.4) p. 384.

2/ Frank C. Ripley, "An Analysis of the Eckstein-Wilson Wage Determination Model", Quarterly Journal of Economics, LXXX (February 1966) pp. 121-136.

3/ (a)   Standard deviation among industries

$$\left[\frac{\sum\limits_{i=1}^{13} \sum\limits_{j=1}^{12} W_{ij}^2}{13 \times 12} - \left(\frac{\sum \sum W_{ij}}{13 \times 12} \right)^2 \right]^{\frac{1}{2}}$$

    (b)   Standard deviation over time

$$\left[\frac{\sum\limits_{j=1}^{12} \bar{W}_{ij}^2}{12} - \left(\frac{\sum \bar{W}_j}{12} \right)^2 \right]^{\frac{1}{2}}$$

where:

W_{ij} = percentage wage rate change in the ith year and the jth industry

i = 1, 2, ... 13, number of observations in each industry

j = 1, 2, ... 12, number of industries

and $\bar{W}_j = \dfrac{\sum\limits_{i=1}^{13} W_{ij}}{13}$ is the average annual percentage wage rate change in the jth industry

4/ This picture is quite different for the United States if the calculations for the United States are based on the wage periods designated by Eckstein and Wilson. See Eckstein and Wilson op. cit., Table A-II p. 411 and Ripley, op. cit., Table 1 p. 126.

5/ Ripley, op. cit., discusses this procedure and its application.

6/ One could of course use the data in Table IV to construct another definition of the key group. This procedure, however, makes it impossible to test the hypothesis under review since the procedure used to select key-group industries implies the characteristics on which the hypothesis is based.

7/ Eckstein and Wilson, op. cit., p. 387.

8/ E. Kuh, op. cit., p. 346.

9/ Economic Council of Canada, Third Annual Review, (Ottawa: Queen's Printer, 1966) pp. 130-2.

10/ Ibid., p. 131.

11/ Ibid., p. 132.

12/ These dates for the past—1960 period coincide with the dates given by Eckstein in "Money Wage Determination Revisited", op. cit., p. 137.

13/ These data are presented by Alton W. J. Craig and Harry J. Waisglass in "Collective Bargaining Perspectives", a paper presented to the 5th Annual Conference of the Canadian Industrial Relations Institute, Toronto, Ontario, June 12, 1968, mimeographed.

14/ Presumably absolute wage changes could be obtained by going back to the computer but this was not done.

15/ This is evident from the Sparks-Wilton estimate (equation III.6) which unemployment enters in one form or another three times as a highly significant explanatory variable and which also includes a relative wage variable (B) that is highly significant.

16/ No attempt has been made to explore alternative definitions of the key group based on such variables as skill groups, labour mobility or relative wages. Sara Behman in "Wage Determination in United States Manufacturing", The Quarterly Journal of Economics, LXXXII (February 1968) pp. 117-42 emphasizes skill levels. Holt, op. cit., emphasizes gross flows and the wage structure. Lack of data makes it impossible to pursue this type of analysis very far for Canada.

CHAPTER V

SUMMARY AND CONCLUSIONS

The principle purpose of this study has been to identify the primary determinants of wage changes in Canadian manufacturing industries at the two-digit level of disaggregation. In Chapter II a model is developed for this purpose cast within a demand and supply framework. The demand for labour inputs (man-hours) is assumed to be a function of the output of each industry, a secular trend and an adjustment factor. The supply of labour is assumed to be a function of the level of unemployment, the wage in the particular industry relative to the wage in all manufacturing, the wage in the particular industry relative to the wage in the same industry in the United States and profits per unit of output in the particular industry. The change in wages in any industry is assumed to be a function of the excess demand for labour.

In Chapter III the employment functions required to apply this model are presented together with wage change relationships estimated for each industry. Although the evidence is subject to several limitations, it is generally consistent with the view that in the majority of industries wage changes are associated with changes in the relative wage (i.e., the indus-try's wage relative to the general wage level in Canada), and in the general

level of unemployment. The influence of the demand for labour, as measured in our tests, is also discernible in a majority of industries. The factors that show through least clearly are the level of industry wages relative to the level of wages in the same industry in the United States and profits.

This evidence is broadly consistent with the aggregative wage-change relationships that have been estimated for Canada. Moreover, these estimates emphasize that general economic conditions have an important influence on wage changes in particular industries, including wage changes negotiated under collective agreements generally, by comparison with influences that are peculiar to particular industries. Although all the variables entering these relationships reflect the general economic conditions prevailing in the country, these environmental factors are directly reflected in the level of unemployment in the community and the overall level of wages. In quite a number of industries the influence of these environmental factors seems to be conditioned by variations in the demand for labour in particular industries. The level of wages in the same industry in the United States and the profitability of the industry do not appear to condition the effect of these other influences very much in most industries.

The limited information that is available provides only mild evidence of a significant association between strikes and the rate of change in wages negotiated under collective agreements. In addition, the degree of unionization across industries is not significantly correlated with the rate of change in wages across industries from 1961 to 1966, nor does it seem in general to be related in a systematic way to the role of profits and United States wages in influencing wage changes in Canadian manufacturing industries, as indicated in the wage-change relationships presented in Chapter III.

In Chapter IV consideration is given to the hypothesis that wage changes in a key group of Canadian industries, having certain common characteristics, establish a pattern which wages in other industries follow and that a bargaining cycle is evident in the pattern of wage changes established by the key group. Little or no evidence has been found to support the key industry hypothesis for Canada. The identity of the key group of Canadian industries is in doubt; the existence of the assumed bargaining cycle is in doubt; and when wage changes in an assumed key group of Canadian industries are related to wage changes in particular industries, it is doubtful whether these key group wage changes are any more closely associated with wage changes in non-key industries than are wage changes in manufacturing generally.

Something can perhaps be made of the key group hypothesis if instead of defining the key group in terms of industries it is defined in terms of employees covered by collective bargaining units. The evidence is consistent with the view that the wage settlements arrived at by collective bargaining units for the economy generally have a positive relationship with wage changes in many individual Canadian industries. However, because of the close relationship between wage changes arrived at in collective bargaining settlements, averaged for the economy as a whole, and general economic conditions, it has not been possible to separate the influence of collective bargaining settlements per se on wage changes in particular industries from the influence of general economic conditions.

APPENDIX A

DATA SOURCES

Due to a change in the Canadian Standard Industrial Classification in 1962, some problems were encountered in collecting a consistent series of data. This changeover seems to have had little effect on the wage change data at the two-digit industry level. Adjustments were required in only two of the following two-digit industries: iron and steel products and non-ferrous metal products under the old Standard Industrial Classification. Under the new Standard Industrial Classification the industries are now sub-divided into three rather than two categories. The industries, as given below, are roughly comparable for the two S.I.C.:

```
         Primary Metal Industries           )
                                            )   NEW
         Metal Fabricating Industries       )   S.I.C.
                                            )
         Machinery except electrical        )


         Iron and Steel                     )   OLD
                                            )   S.I.C.
         Non-Ferrous Metal                  )
```

To make the data comparable we isolated the major three-digit indus-tries to provide a link to the old S.I.C. This, however, was necessary only for the year 1966.

In comparing the United States S.I.C. with our own, some differences were found, but these appeared to be minor and no adjustments were made to try to attain greater comparability.

Greater difficulty arose in connection with profits data. First, published D.B.S. data in many cases do not provide the industry breakdown required. For example, the published figures do not provide separate estimates of profits for both the clothing and textile industry. Accordingly, it was necessary to use the estimate of profits for textiles and clothing combined. A second and more serious problem arose because of the change in the S.I.C. in 1962. This posed the difficulty of deriving a reliable profits series for both the iron and steel industry, and the non-ferrous metals industry. In order to do this, we used the total profit figure for the three industries previously shown to be comparable to the iron and steel and non-ferrous metals industries. We then apportioned total profits on the basis of the proportion of profits between the industries before 1962. This is admittedly an arbitrary procedure, but no better method was feasible.

The sources of the data employed are as follows:

MH_i = Man-hours per week employed in the ith industry.
SOURCE: D.B.S. Review of Employment and Payrolls (72-201), D.B.S. Review of Man-hours and Hourly Earnings (72-202).

Q_i = Output in the ith industry.
SOURCE: D.B.S. Index of Industrial Production (61-005).

W_T = Average hourly earnings in manufacturing.

SOURCE: D.B.S. Review of Man-hours and Hourly Earnings (72-202).

W_i = Average hourly earnings in the ith industry.

SOURCE: D.B.S. Review of Man-hours and Hourly Earnings (72-202).

U = The percentage of the labour force unemployed in manufacturing.

SOURCE: D.B.S. Canadian Statistical Review (11-003).

Π_i = Index of the level of profits per unit of output in the ith industry.

SOURCE: D.B.S. Corporation Profits (61-003), D.B.S. Index of Industrial Production (61-005).

W_{us_i} = Average hourly earnings in the ith industry in the United States.

SOURCE: United States Department of Commerce, Business Statistics Annual Supplement.

APPENDIX B

LA DETERMINATION DES SALAIRES DANS
L'INDUSTRIE MANUFACTURIERE CANADIENNE*

RESUME

Une partie importante des recherches les plus récentes portant sur les
salaires visait à examiner la question fondamentale suivante, à savoir l'in-
fluence exercée par la demande globale ainsi que par les forces concurren-
tielles du marché sur les changements du taux nominal de salaire, d'une
part, et l'influence d'autres facteurs, tels le pouvoir des syndicats, les
contraintes institutionnelles, le sentiment d'émulation qui existe entre
les divers segments du marché du travail, ainsi que d'autres facteurs parti-
culiers à certaines industries, d'autre part. A quelques exceptions près,
ces recherches n'ont pas tenu compte des divers secteurs industriels de
l'économie, et elles ont de plus ignoré l'influence que les changements de
salaire dans un pays voisin exercent sur les changements de salaire dans le
pays étudié. Au même moment où ces recherches s'effectuaient, un autre
effort de recherche se dessinait portant cette fois sur la relation qui
existe, en courte période, entre les changements des niveaux de l'emploi et
de la production dans l'industrie manufacturière, dans tout le secteur

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* Ce résumé est une version abrégée d'un article qui paraîtra sous peu dans
la Review of Economic Studies sous le titre: "Wage Adjustments in Canadian
Industry, 1953-66", (October 1970).

manufacturier pris dans son ensemble, et également dans chaque industrie
considérée isolément. Ces deux courants de recherche se sont développés
indépendamment l'un de l'autre, en dépit du fait que les changements de
salaire ne sont évidemment pas étrangers aux variations de l'emploi, dès
lors qu'on est prêt à reconnaître l'influence parfois déterminante des
forces du marché.

La présente étude comporte deux parties. Dans la première partie,
nous nous inspirerons des deux courants de recherches mentionnés ci-haut
pour construire un modèle qui servira à identifier les principaux facteurs
qui déterminent les changements de salaire dans les plus importantes in-
dustries manufacturières (à deux chiffres près dans la classification
industrielle type). Le modèle sera appliqué aux données trimestrielles
canadiennes pour la période allant de 1953 à 1966 inclusivement. Dans
la seconde partie, le modèle servira à l'analyse de l'influence qu'exer-
cent les négociations collectives menées dans certains secteurs clef sur
les changements de salaire au Canada.

1. Un modèle visent à analyser les facteurs qui déterminent les changements de salaires dans l'industrie manufacturière

Lorsqu'on veut analyser les facteurs qui déterminent les changements
de salaire dans chaque industrie, il n'est pas légitime de se limiter à
l'estimation, pour chaque industrie, de "courbes de Phillips" que d'autres
ont utilisées pour étudier des phénomènes globaux. Il est évident que
les salaires versés dans une industrie subissent l'influence de ceux qui
sont versés dans les autres. De plus, le concept de chômage est vide de
sens si on l'applique au niveau d'une industrie, étant donné la facilité
avec laquelle les ouvriers peuvent passer d'une industrie à l'autre;

cela est surtout vrai dans le cas des travailleurs les moins spécialisés,
qui constituent la fraction la plus importante des chômeurs. Enfin, il est
probable que les salaires versés dans une industrie subissent l'influence
de plusieurs facteurs qui sont particuliers à cette industrie: profits,
demande pour le produit, pouvoir des syndicats, etc. Le modèle que nous
allons construire tiendra compte de ces divers facteurs et cherchera à expli-
quer les changements de salaire en fonction de la demande excédentaire de
main-d'oeuvre dans chaque industrie. Le modèle sera présenté en deux temps.
Premièrement, il faudra obtenir la demande de main-d'oeuvre dans chaque
industrie: deuxièmement, l'on pourra utiliser cette demande en conjonction
avec l'offre de main-d'oeuvre dans chaque industrie, en vue d'obtenir une
estimation des facteurs qui déterminent les changements des taux nominaux
de salaire.

a) La demande de main-d'oeuvre
   dans une industrie

Comme d'autres chercheurs l'ont fait auparavant, l'on peut obtenir,
pour toute industrie $\underline{i}$, en courte période, une fonction de demande de main-
d'oeuvre définie comme suit:

$$MH_i = f_i \left[\overset{+}{Q_i}, \overset{-}{t}, \overset{+}{(MH_i)}_{t-1}, \overline{D} \right] \tag{1}$$

où: MH_i = est le nombre d'heures-hommes dans l'industrie $\underline{i}$;

  Q_i = est le niveau de production de l'industrie $\underline{i}$;

  $\underline{t}$ = est une variable qui identifie chaque trimestre;

  $\underline{D}$ = est une variable saisonnière fictive.

    (une pour chaque trimestre);

et le signe attendu est indiqué au-dessus de chaque variable explicative.

L'équation (1) peut être estimée, soit sous une forme linéaire en loga-
rithmes, ce qui suppose une fonction de production dont l'élasticité de sub-
stitution est constante, soit sous une forme linéaire simple, après y avoir
incorporé un mécanisme d'ajustement automatique dans chaque cas. En principe,
l'une et l'autre forme sont légitimes. Ainsi, plusieurs études portant sur
la demande de main-d'oeuvre ont utilisé l'équation (1) dans sa forme linéaire
en logarithmes. Cependant, la forme que l'on préfère doit relever d'un choix
empirique, et non des précédents en la matière. Que l'on opte pour l'une ou
l'autre forme, il est important de noter que l'équation (1) diffère des fonc-
tions usuelles de demande, en ceci que les prix (salaires) n'apparaissent
pas parmi les variables indépendantes. Cette omission s'explique uniquement
par la non disponibilité des données statistiques requises. Cependant,
l'omission ne risque pas de biaiser sérieusement les resultats car, dans le
contexte d'une analyse de courte période, l'élasticité-prix de la demande
de main-d'oeuvre peut être considérée comme relativement faible. Enfin,
l'inclusion parmi les variables indépendantes d'une variable temporelle iden-
tifiant chaque trimestre sert à refléter les facteurs de longue période, tels
les progrès techniques et les changements séculiers que subit l'offre relati
tive des divers facteurs de production.

Encore deux remarques en ce qui concerne l'équation (1). Premièrement,
cette équation se rapporte à chaque industrie en particulier, et non à
l'industrie manufacturière dans son ensemble. Deuxièmement, l'on a utilisé
comme variable dépendante le nombre d'heures-hommes, plutôt que le nombre de
travailleurs employés, car c'est la détermination du prix d'une heure-homme
de travail, exprimé sous la forme d'une rémunération horaire moyenne, qui
fait l'objet de la présente étude.

Si l'on pose $(MH_i)_t = (MH_i)_{t-1}$, l'on peut alors utiliser l'équation (1) pour calculer MH^*, c'est-à-dire la quantité d'heures-hommes demandée en situation d'équilibre. Désignant ensuite par MH_i le niveau d'emploi réalisé au cours d'un trimestre donné, l'on peut obtenir $MH_i - MH_i^* = e_i$, qui représente le nombre de vacances en heures-hommes dans chaque industrie au cours de ce semestre. Comme la valeur de MH_i^* dépend d'une estimation empirique, e_i possède donc deux composantes: d'abord, une composante aléatoire, qui reflète les facteurs exogènes qui sont exclus de l'équation (1) et dont l'espérance mathématique est supposée égale à zéro dans le temps ensuite, une composante décolée, qui reflète le retard d'ajustement entre l'emploi désiré et l'emploi réalisé.

En fait, l'équation (1) permet d'en arriver à deux estimations différentes du nombre d'heures-hommes "désiré" par une industrie. D'abord, MH_i^* représente le nombre d'heures-hommes que les employeurs désirent éventuellement se procurer, à la condition que les autres variables indépendantes ne subissent aucune variation. Ensuite, $\widehat{MH}_i$ — le nombre d'heures-hommes par trimestre, tel qu'estimé au moyen de l'équation (1) — représente le nombre d'heures-hommes que les employeurs désirent avoir à la fin du trimestre, compte tenu des variations du niveau de la production.

Il existe au moins deux raisons pour croire que, _à priori_, les changements de salaire seront mieux expliqués par $\widehat{MH}_i$ que par MH_i^*. En premier lieu, les variations du niveau de la production, au cours d'un semestre donné, créent beaucoup d'incertitude. En répartissant les rajustements nécessaires sur plusieurs trimestres, plutôt que de les effectuer instantanément, les employeurs peuvent au moins partiellement éviter de réagir inutilement aux facteurs aléatoires, tout en se préparant à effectuer les

rajustements permanents qu'ils entendent faire subir au niveau de production.
En second lieu, comme ils ne connaissent pas avec précision le niveau futur
des salaires en équilibre, les employeurs préfèrent en général rajuster les
salaires vers la hausse d'une façon graduelle, plutôt que d'un seul coup:
même en l'absence de toute incertitude à ce sujet, il est probable qu'un
rajustement graduel soit moins couteux aux employeurs qu'un rajustement plus
rapide. En effet, s'il fallait compléter le rajustement au cours du semes-
tre, les coûts directs de recrutement seraient probablement plus élevés. De
plus, l'augmentation des salaires requise pour atteindre le nombre d'heures-
hommes en situation d'équilibre à la fin du trimestre courant sera sans
doute plus élevée, par comparaison avec ce qu'elle aurait été si les employ-
eurs avaient cherché à atteindre le nouvel équilibre d'une façon plus gra-
duelle il convient de noter que cette augmentation différentielle serait
versée non seulement aux nouveaux employés, mais aussi à ceux qui étaient
déjà employés dans l'industrie. Il en va de même dans le cas des réductions
d'emploi: les coûts seront moindres et les rajustements non nécessaires mini-
misés, si les réductions sont effectuées sur une période de deux ou trois
trimestres, plutôt qu'au cours d'un seul trimestre.

b) L'offre de main-d'oeuvre dans une industrie

L'on peut supposer que l'offre de main-d'oeuvre dans une industrie i
dépend: (a) du salaire (rémunération horaire moyenne) versé dans cette in-
dustrie, relativement au salaire versé dans tout le secteur manufacturier,
W_i/W_t ; (b) de l'inverse de la racine carrée du niveau du chômage dans le
secteur manufacturier, U^{*-2} , calculé d'après une moyenne mobile de cinq
trimestres qui sera définie exactement sous peu; (c) du salaire versé dans
l'industrie américaine correspondante, W_i/W_{us_i} ; (d) des profits par unité

de production dans l'industrie i, calculés selon une moyenne mobile de qua-
tre trimestres et décalés de deux trimestres, de telle sorte à tenir compte
d'un certain retard d'information, $(\pi^*_i)_{t-2}$. Nous avons donc:

$$S_i = g_i \left[\overset{+}{W_i/W_t} , \overset{-}{U^{*-2}}, \overset{+}{W_i/W_{us_i}} , \overset{-}{(\pi_i^*)_{t-2}} \right] \qquad (2)$$

où le signe attendu est indiqué au-dessus de chaque variable explicative.

La raison pour laquelle la variable W_i/W_t est incluse dans l'équation
(2) tient au fait que l'offre de main-d'oeuvre dans une industrie donnée
dépend du taux de salaire versé dans cette industrie, relativement au taux
de salaire offert dans d'autres industries. Ainsi, l'on peut s'attendre à
ce qu'une augmentation de W_i/W_t augmente le nombre d'heures-hommes offertes
dans une industrie, tandis qu'une réduction de W_i/W_t produira l'effet con-
traire. Quant aux autres facteurs, tel l'indice des prix à la consommation
qui influencent le niveau général des salaires dans toute relation macro-
économique d'ajustement des salaires, leur influence s'exerce ici sur W_t.

Quant au niveau de chômage dans l'économie, non seulement a-t-il une
influence indirecte sur l'offre de main-d'oeuvre dans une industrie par
l'action qu'il exerce sur W_t, mais encore exerce-t-il une influence directe
à un taux de salaire donné. En effet, si le chômage est élevé, aucune (ou,
à tout le moins, seule une légère) augmentation du taux de salaire n'est
requise, si l'on désire embaucher davantage de main-d'oeuvre. Il n'en va
pas de même lorsque le taux de chômage est peu élevé, car alors il devient
impossible d'embaucher plus de main-d'oeuvre sans augmenter considérablement
le taux de salaire. De plus, si l'on se fie à la plupart des estimations
de la courbe de Phillips, il faut reconnaître que l'influence du chômage
sur l'offre de main-d'oeuvre n'est pas linéaire. D'où l'inclusion de l'in-
verse de la racine carrée du niveau de chômage dans l'équation (2), de telle

sorte à ce que cette dernière reflète l'influence changeante du chômage sur
l'offre de main-d'oeuvre à différents taux de chômage. L'on peut interpré-
ter $\underline{U}*^{-2}$ comme une variable qui occasionne un déplacement de la courbe
d'offre de main-d'oeuvre lorsque le niveau de chômage varie. L'inclusion
de cette variable sous une forme non-linéaire signifie que le déplacement
de la courbe d'offre de main-d'oeuvre occasionné par un changement unitaire
du niveau de chômage sera d'autant plus grand que le taux de chômage sera
peu élevé. De plus, l'on suppose que $\partial S_i / \partial U*^{-2} < 0$. Enfin, comme $U*^{-2}$ est
calculé d'après une moyenne mobile de cinq trimestres (avec des coefficients
de pondération appropriés), l'inclusion de cette variable introduit un déca-
lage échelonné dans l'équation (2).

Si le marché du travail était parfaitement concurrentiel, l'on pourrait
supposer que l'offre de main-d'oeuvre dans une industrie donnée s'explique
uniquement par le taux de salaire relatif et le niveau de chômage. Cepend-
ant, une telle hypothèse devient pour le moins suspecte, dès lors qu'on
reconnaît l'existence de la négociation collective dans une bonne partie de
l'industrie manufacturière canadienne. En effet, l'influence que les unions
ouvrières exercent sur les salaires se manifeste par le pouvoir de monopole
que possèdent ces dernières, c'est-à-dire par le pouvoir qu'elles possèdent
de causer un déplacement de la courbe d'offre de main-d'oeuvre. Il faudrait
donc que l'équation de l'offre de main-d'oeuvre dans une industrie donnée
tienne compte de l'influence des unions ouvrières. Cependant, il n'est pas
facile de déterminer, a priori, la meilleure façon d'introduire cette influ-
ence dans l'équation (2).

Il semble qu'il n'existe aucune variable dont l'inclusion dans l'équa-
tion (2) serait de nature à refléter directement l'influence que les unions

ouvrières exercent sur l'offre de main-d'oeuvre. Face à l'impossibilité de
mesurer directement le pouvoir des unions ouvrières, il faut se rabattre sur
d'autres variables, dont l'inclusion refléterait, par procuration, ce pou-
voir que possèdent les syndicats. Ces autres variables pourraient, par
exemple, se rapporter au climat économique qui semble en général accompagner
les augmentations de salaires. Cependant, le climat économique exerce déjà
une influence sur $\underline{W}_t$ and $\underline{U}^{*-2}$. Ou bien, s'il faut en croire les arguments
qu'utilisent les syndicats au cours des conventions collective, il semble
que le pouvoir que ces derniers jugent bon d'exercer sur l'offre de main-
d'oeuvre est à son tour influencé par les marges bénéficiaires et l'écart
entrelles salaires versés dans une même industrie au Canada et aux Etats-
Unis, d'où l'inclusion de π_i^* et $\underline{W}_i/\underline{W}_{us_i}$ dans l'équation (2).

L'on ne peut nier que les syndicats attachent une très grande impor-
tance aux profits réalisés dans une industrie. Cependant, il existe plu-
sieurs façons de mesurer les profits et il est difficile de déterminer, à
priori, celle qui est le plus fréquemment utilisée par les syndicats pour
fins de négociation. Nous avons choisi d'utiliser les profits par unité de
production, plutôt que les profits par unité de capital investi, non seule-
ment parce que ces données sont les seules qui sont disponibles sur une base
trimestrielle, mais aussi parce qu'elles sont moins sujettes à caution, même
sur une base annuelle. De plus, l'on peut supposer que les syndicats attri-
buent à l'écart entre le prix des facteurs par unité de production et le
prix unitaire de cette production (c'est-à-dire aux profits par unité de
production) au moins autant d'importance qu'ils en prêtent au taux de rende-
ment sur le capital investi, surtout si l'on se rappèle que les estimations
du capital investi dans chaque industrie canadienne sont trop périmées pour
que les syndicats s'y fient dans leurs négociations courantes, sans

mentionner le fait que ces estimations sont par ailleurs douteuses au moment
même où elles sont publiées pour la première fois.

La raison pour laquelle la variable π_i^* a été incluse sous la forme
d'une moyenne mobile de quatre trimestres, avec un décalage de deux semes-
tres, tient au fait qu'il est raisonnable de supposer qu'il existe un déca-
lage entre le moment où les profits sont réalisés et le moment où les données
statistiques, une fois publiées, servent au cours des négociations collec-
tives. Bien que le calcul de π_i^* selon une moyenne mobile introduise déjà
un décalage échelonné dans l'équation (2), l'on a néanmoins introduit un
autre décalage fixe d'une durée de deux trimestres, comme plusieurs l'ont
fait dans d'autres études. De plus, étant donné que les changements des
salaires et des marges bénéficiaires sont probablement interdépendants, la
précision de l'estimation statistique exige qu'au moins une partie des pro-
fits soit prédéterminée. Cette façon d'inclure les profits dans l'offre de
main-d'oeuvre implique donc que toute augmentation des marges bénéficiaires
occasionne une réduction de l'offre de main-d'oeuvre, c'est-à-dire
$\partial S_i/\partial \pi_i^*_{-2} < 0$.

La variable W_i/W_{us_i} nécessite quelques commentaires additionnels. En
effet, le salaire versé aux Etats-Unis dans une industrie donnée peut influer
de diverses façons sur le salaire versé dans l'industrie correspondante au
Canada. Premièrement, étant donné que plusieurs syndicats canadiens sont
affiliés aux syndicats américains, les premiers sont susceptibles d'être
influencés par les seconds, non seulement en ce qui touche à la politique
syndicale, mais également en ce qui a trait à la disponibilité des données
statistiques et à l'habilité à négocier. Bien plus, comme le siège des
syndicats internationaux ainsi que la plupart des syndiqués se trouvent aux
Etats-Unis, les politiques syndicales tendent à réfléter fidèlement les

besoins américains et se prêtent donc mal à une adaptation aux conditions
canadiennes. Deuxièmement, même lorsqu'elles ne sont pas affiliées aux
syndicats américains, les unions ouvrières canadiennes peuvent modeler leurs
demandes salariales sur les salaires américains. Un exemple récent nous est
fourni dans les efforts qui sont tentés dans plusieurs industries canadien-
nes, en particulier dans l'industrie de l'automobile, pour réaliser la
"parité de salaire" avec les Etats-Unis. Dans la plupart des cas, les
syndicats cherchent à réaliser cette parité sans tenir compte du taux de
change entre les dollars canadien et américain. Troisièmement, il est con-
cevable que les augmentations de salaire dans maintes industries américaines
ont des effets de débordement sur les salaires canadiens, tout comme de sem-
blables effets de débordement se font sentir d'une industrie à l'autre aux
Etats-Unis, ainsi que l'on indiqué quelques recherches. Cependant, le méca-
nisme en vertu duquel ces effets se répercutent au Canada est mal connu.
Quoi qu'il en soit, il n'est pas déraisonnable de supposer que c'est aux
Etats-Unis, et non au Canada, que l'on trouvera la plupart des ententes col-
lectives "modèles" qui fixent le pas. Quatrièmement, l'étroite concurrence
qui existe entre les deux pays sur le marché de certains biens peut influer
indirectement sur les changements des salaires dans les deux pays. Etant
donné l'écart qui existe entre les deux pays du point de vue du niveau de
la production dans toutes les industries, cette concurrence produit l'effet
d'une contrainte imposée aux demandes salariales au Canada. Ainsi, si les
salaires et, par voie de conséquence, les prix augmentent aux Etats-Unis,
une augmentation correspondante est dorénavant possible au Canada. Enfin,
il est possible que la variable W_i/W_{us_i} exerce une influence directe sur
l'offre de main-d'oeuvre dans certaines industries, à cause de la mobilité
des travailleurs, surtout dans le voisinage des villes frontalières, telles
Windsor et Détroit.

Bien entendu, l'importance relative des diverses influences décrites ci-haut variera d'une industrie à l'autre. Cependant, quoi qu'il en soit de l'importance relative de chacune de ces influences, si la variable W_i/W_{us_i} exerce une influence quelconque sur l'offre de main-d'oeuvre dans une industrie, cette influence sera positive, c'est-à-dire $\partial S_i / \partial (W_i/W_{us_i}) > 0$.

c) Le modèle

Utilisant l'hypothèse dynamique de Walras, l'on peut supposer que le taux de changement des salaires par unité de temps dans une industrie donnée, dW_i/dt, est proportionnel à la demande excédentaire de main-d'oeuvre, XD_i, définie comme étant la différence entre les quantités de main-d'oeuvre demandées et offertes à un taux donné de salaire. C'est-à-dire:

$$dW_i/dt = \lambda(XD_i) = \lambda(D_i - S_i) \tag{3}$$

Tel qu'indiqué précédemment, l'on peut substituer $\widehat{MH}_i$ ou MH_i^* à D_i dans l'équation (3). Compte tenu des raisons pour lesquelles l'on peut s'attendre à ce que les changements de salaire soient plus adéquatement expliqués par $\widehat{MH}_i$ que par MH_i^*, seule la première de ces deux variables sera retenue dans les équations qui suivent, bien que les deux aient été utilisées pour en arriver aux estimations présentées dans la section suivante. En supposant que l'équation (2) soit linéaire, l'on peut réécrire l'équation (3) de la façon suivante:

$$\Delta W_i = \lambda \left\{ MH_i - \left[\overset{-}{\alpha_0} + \overset{+}{\alpha_1} W_i/W_T + \overset{-}{\alpha_2} U^{*-2} + \overset{+}{\alpha_3} W_i/W_{us_i} + \overset{-}{\alpha_4} (r^*_\perp)_{t-2} \right] \right\} \tag{4}$$

où $\Delta W_i \sim dW_i/dt$. Comme tout à l'heure, le signe attendu de chaque coefficient est indiqué au-dessus de ce dernier. En vertu de l'hypothèse de proportionalité faite plus haut, l'équation (4) peut se réduire à:

$$\Delta W_i = \beta_0 + \lambda \overset{+}{\overset{\wedge}{MH}}_i + \overset{-}{\beta}_1 W_i/W_T + \overset{+}{\beta}_2 U^{*-2} + \overset{-}{\beta}_3 W_i/W_{us_i} + \overset{+}{\beta}_4 (\pi^*_i)_{t-2} \qquad (5)$$

où $\beta_j = -\lambda \alpha_j$. Cependant, étant donné que l'offre de main-d'oeuvre dépend des salaires relatifs, la relation postulée ne pourra pas, en général, être proportionnelle. Quoi qu'il en soit, nous allons chercher à obtenir une approximation linéaire de l'équation (5). Dans le cas de λ , le signe attendu est positif. En ce qui concerne les autres paramètres, il faut se rappeler que les signes attendus des paramètres de la fonction d'offre doivent être renversés, étant donné que l'offre est soustraite de la demande dans l'équation (3):

$$\beta_1 = \partial \Delta W_i / \partial (W_i/W_T) < 0$$

$$\beta_2 = \partial \Delta W_i / \partial U^{*-2} > 0$$

$$\beta_3 = \partial \Delta W_i / \partial (W_i/W_{us_i}) < 0$$

$$\beta_4 = \partial \Delta W_i / \partial (\pi^*_i)_{t-2} > 0$$

Avant de présenter les résultats empiriques, il convient d'apporter une précision en ce qui concerne la productivité. Les économistes ne s'entendent pas quant à l'importance respective des profits et de la productivité en tant que facteurs dans la détermination des salaires. Les uns, tels les adeptes de la courbe de Phillips, mettant l'accent sur les profits, tandis que d'autres, tel E. Kuh, insistent sur le rôle primordial des profits. Dans le modèle présenté ici, les profits et la productivité ont chacun leur place. D'une part, la productivité figure implicitement dans la fonction de production de laquelle la demande de main-d'oeuvre est dérivée; d'autre part, les profits apparaissent explicitement dans l'offre de main-d'oeuvre.

2. Les résultats empiriques

Nous avons utilisé l'équation (5) comme base d'estimation dans l'industrie manufacturière canadienne (à deux chiffres près dans la classification

industrielle type). Plus précisément, nous avons procédé en deux étapes.
D'abord, il fallait obtenir la demande de main-d'oeuvre pour chaque industrie,
afin de pouvoir en arriver à une estimation de $\widehat{MH_i}$ et MH_i^*. Ensuite, nous
pouvions obtenir une estimation de l'équation (5). Nous avons utilisé dans
les calculs des données couvrant la période allant de 1953 à 1966 inclusive-
ment, sur une base annuelle et trimestrielle. Seules les estimations fondées
sur les données trimestrielles seront présentées ici. Parmi les problèmes
qui ont entravé l'analyse empirique, mentionnons l'absence de données sur les
salaires incluant les bénéfices marginaux, les modifications apportées en
1960 au système de classification des industries (ce qui nous obligea à
effectuer certains regroupements conformes à l'ancienne classification), et
enfin l'imprécision des données sur les profits.

a) L'estimation de la demande de main-d'oeuvre

Etant donné la causalité bilatérale qui existe entre l'emploi et la pro-
duction, nous avons choisi d'utiliser la méthode des moindres carrés en deux
étapes (TSLS) pour estimer la demande de main-d'oeuvre dans chaque industrie.
Le modèle TSLS utilisé peut s'exprimer comme suit:

$$Q_i = a_0 t + a_1 U^{*-2} + a_2 (\pi^*_i)_{t-2} + a_3 (MH_i)_{t-1} + a_4 D_1 + a_5 D_2 + a_6 D_3 + a_7 D_4 + U$$

$$MH_i = b_0 t + b_1 \hat{Q}_i + b_2 (MH_i)_{t-1} + b_3 D_1 + b_4 D_2 + b_5 D_3 + b_6 D_4 + U \qquad (7)$$

où a_j et b_j sont les paramètres à estimer, $\hat{Q}_i$ est la valeur de Q_i estimée
d'après l'équation (6), et U^{*-2}, t, $(\pi_i^*)_{t-2}$, $(MH_i)_{t-1}$, D_1, D_2, D_3 et D_4
sont des variables dont les valeurs sont données. Plusieurs essais furent
tentés en supposant que la forme des équations à être estimées était linéaire
en logarithmes. Cependant, cette hypothèse n'influa que très peu sur les
résultats obtenus.

En ce qui concerne l'équation (7), nous avons conservé toutes les varia-

bles spécifiées, sans égard à leur signification statistique; la raison tient

au fait que, quoi qu'il en soit de leur signification statistique, les

valeurs estimées des paramètres peuvent être considérées comme les "meilleu-

res" estimations en un point donné. Cependant, les variables dont la valeur

estimée des paramètres était accompagnée d'un signe contraire au signe

attendu furent éliminées; l'on procéda alors à une nouvelle estimation, en

supposant qu'une telle élimination améliorerait les résultats obtenus. Toute-

fois, ce problème ne se présenta que dans quelques cas isolés. Le signe

attendu des coefficients de l'équation (7) sont:

$$b_0 = \partial MH_i / \partial t \leqq 0$$
$$b_1 = \partial MH_i / \partial \hat{Q}_i > 0$$
$$b_2 = \partial MH_i / \partial (MH_i)_{t-1} < 1$$

Les estimations se rapportant à la demande de main-d'oeuvre sont présentées

dans le Tableau III-1.

b) L'estimation de l'équation (5)

Nous avons utilisé comme technique d'estimation la méthode simple des

moindres carrés, utilisant comme définition de la variable dépendante:

$\Delta W_i = W_{i_t} - (W_i)_{t-4}$. Quant aux variables indépendantes, nous les avons

définies comme suit:

$$U^{*-2} = \frac{1}{U^{*2}_t} , \text{ où } U^*_t = \frac{1}{8} U_t + \frac{1}{4} \sum_{j=1}^{3} U_{t-j} + \frac{1}{8} U_{t-4}$$

et U_t est le taux de chômage dans le secteur manufacturier;

$\pi^* = \frac{1}{4} \sum_{j=0}^{3} (Z_i/Q_i)_{t-j} (100)$, qui représente une moyenne mobile

de quatre trimestres des profits par unité de production dans l'industrie $\underline{i}$,

présentée sous la forme d'un indice; Z_i sont les profits avant impôt dans

l'industrie $\underline{i}$, et Q_i est l'indice de production industrielle dans l'industrie $\underline{i}$

W_i est le salaire horaire moyen des collets bleus dans l'industrie $\underline{i}$ au
Canada;

W_{us_i} est le salaire horaire moyen des collets bleus dans l'industrie $\underline{i}$ aux
Etats-Unis;

W_T est le salaire horaire moyen des collets bleus dans l'industrie manufac-
turière canadienne.

Lorsqu'il faut expliquer le changement de salaire entre le temps $(t-4)$
et le temps (t), il faut faire l'option, soit de dater la variable explica-
tive en se fondant sur le début de la période, soit de la dater en se fon-
dant sur la fin de la période. Bien que nous ayons expérimenté en utilisant
conventionnellement ces deux méthodes, la plupart des estimations se fondent
sur la première. En effet, étant donné que c'est le niveau relatif des
salaires qui influe sur les changements de salaire, il est juste de supposer
que le niveau relatif des salaires au temps (t) exerce ses effets sur les
changements de salaires au temps $(t + 1)$, plutôt qu'au temps $(t - 1)$.

La détermination préalable des décalages est extrèmement importante
lorsque les données utilisées sont trimestrielles, car alors les délais
d'interaction entre les diverses variables sont très courts et varient d'une
variable à l'autre. En ce qui concerne les décalages échelonnés qui ont été
introduits dans la définition des variables U^{*-2} et π^*_i , nous avons adopté
la méthode utilisée dans le modèle de l'Institut Brookings, ainsi que dans
plusieurs autres études. De plus, nous avons introduit un décalage fixe dans
la définition du taux relatif des salaires ainsi que dans celle des profits
par unité de production. Quant aux variables $\hat{MH}_i$ et MH^*_i , obtenues à partir
de la demande de main-d'oeuvre qui incorpore elle-même un décalage, elles
ont été incluses dans l'équation (5) sans aucun décalage additionnel. Enfin,

dans le but de tenir compte de l'influence des changements récents de salaire

sur les changements présents de salaire, nous avons repris toutes les estima-

tions de l'équation (5) en y incluant cette fois comme nouvelle variable

explicative la valeur décalée de la variable dépendante: $\Delta W_{t-4} = W_{t-4} - W_{t-8}$.

Quelques-uns des résultats obtenus lors de l'estimation de l'équation

(5) sont présentés au Tableau III-3. La décision d'inclure ces résultats se

fonde sur un certain nombre de critères, y inclus la valeur estimative de $\bar{R}^2$,

les résultats de tests Durbin-Watson et "student - t", la justesse du signe

accompagnant la valeur estimative des coefficients, et d'autres encore.

Quant aux autres résultats, on peut les considérer comme non significatifs.

Le but principal de toutes ces estimations consistait à identifier empi-

riquement les facteurs qui sont associés aux changements de salaire dans

l'industrie, compte tenu de l'importance relative de chaque industrie. Dans

ce contexte, il faut donc juger des facteurs déterminants des changements de

salaire d'après la signification statistique de la valeur estimative de cha-

cun des coefficients accompagnant les variables explicatives. Les résultats

obtenus sont présentés au Tableau III-4, compte tenu des estimations présen-

tées au Tableau III-3 et d'autres estimations fondées sur des données trimes-

trielles. Bien entendu, les résultats présentés au Tableau III-4 reflètant

une certaine mesure d'interprétation subjective. Nous avons ordonné les

colonnes du Tableau III-4 par ordre décroissant, de gauche à droite, selon

le nombre d'industries dans lesquelles chacune des variables explicatives

désignées semble constituer un facteur déterminant des changements de salaire.

En se fondant sur ces résultats, que peut-on dire des déterminants des

changements de salaire dans diverses industries? La variable la plus forte-

ment déterminante est sans contredit W_i/W_t ; la valeur explicative de cette

variable est très forte dans le cas de huit industries, mais plutôt faible dans une seule des quatre industries qui restent. Quant au niveau de chômage il apparaît comme très important dans sept industries et comme moins important dans une seule. En ce qui concerne la quantité de main-d'oeuvre demandée, telle que définie dans la présente étude, elle est retenue fortement dans six cas, plus faiblement dans deux autres cas, et elle semble sans effet dans les quatre autres industries. La variable W_i/W_{us_i} apparaît comme fortement déterminante dans seulement trois industries, et comme faiblement déterminante dans une autre industrie; elle semble sans effet dans les huit autres industries. Enfin, il en va de même du pouvoir d'explication de π^*_i; il est important dans trois cas, plutôt faible dans un autre cas, et pratiquement inexistant dans les huit autres.

Ces résultats, bien que non concluants, sont quand même conformes à la notion néoclassique, à l'effet que les changements de salaire reflètent davantage les variables apparentées au marché du travail lui-même, plutôt que le pouvoir de monopole des syndicats. L'on a présenté ces variables au Tableau III-4, en fonction des salaires relatifs au Canada, du niveau de chômage et de la demande de main-d'oeuvre dans chaque industrie. La variable W_i/W_{us_i} ne semble jouer qu'un rôle mineur; tel qu'indiqué précédemment, cette variable semble refléter la concurrence qui existe sur les marchés des biens et du travail, en plus de représenter par procuration, l'utilisation que les syndicats font de leur pouvoir de monopole dans le but d'occasionner des d déplacements de l'offre de main-d'oeuvre. Quant aux profits par unité de production, qui semblent refléter le plus fidèlement le pouvoir des syndicats, ils ne semblent influencer les changements de salaire que dans trois industries: le matériel de transport, les appareils électriques et les métaux non-ferreux.

3. **L'influence des secteurs-clef et des
   conventions collectives "modèles"**

Il est généralement reconnu que les changements de salaire dans l'indus-
trie sont occasionnés, du côté de l'offre de main-d'oeuvre, par un changement
des salaires relatifs et, du côté de la demande de main-d'oeuvre, par des
changements qui s'expliquent par la fonction de production; de plus, les
changements de salaire dans un secteur provoquent des effets-revenu qui se
répercutent sur la demande de main-d'oeuvre dans d'autres secteurs. Dans ce
contexte, l'influence qu'exercent les secteurs-clef et les conventions col-
lectives "modèles" nous oblige à apporter deux modifications à notre analyse.
Premièrement, l'évolution des salaires dans les secteurs-clef tend à déter-
miner la vitesse d'évolution des salaires dans les autres industries. Deuxiè-
mement, il appert qu'il soit plus important d'analyser les changements de
salaire sur la durée du cycle de négociation des secteurs-clef, plutôt que
trimestriellement ou annuellement.

Avant de procéder à l'analyse de ces nouvelles influences dans le pro-
cessus de détermination des salaires, l'on doit d'abord chercher à identifier
précisément les secteurs-clef et déterminer la durée de leur cycle de négo-
ciation. Ensuite seulement peut-on analyser l'interaction entre les secteurs-
clef et le reste de l'économie.

Aux fins de la présente étude, nous avons utilisé trois définitions de
ce qu'est un secteur-clef. Le premier secteur-clef (I) est celui qu'ont
défini Eckstein et Wilson dans le contexte américain; bien que ces auteurs
n'aient pas utilisé une méthode très rigoureuse, leurs résultats ont été
confirmés par Ripley en utilisant des techniques statistiques éprouvées. Le
second secteur-clef (II) a été défini sur la base de certaines caractéristi-
ques de l'industrie canadienne, tels le pouvoir de monopole des syndicats,

le niveau relatif des salaires, le taux passé d'augmentation des salaires,
les relations d'interdépendance avec d'autres industries-clef, ainsi que
l'importance relative de la main-d'oeuvre. Quant au troisième secteur-clef
(III), on l'a défini comme comprenant les employés inclus dans un échantil-
lon de 133 conventions collectives où l'unité de négociation couvrait plus
de 500 employés.

L'on a ensuite procédé à une série de tests dans le but de déterminer
la validité de la définition des secteurs-clef I et II. Ces tests compre-
naient, entre autres, une analyse du discriminant et de la principale compo-
sante que Ripley avait utilisée sur des données américaines. Aucune de ces
deux définitions n'a survécu à ces tests.

La détermination de la durée du cycle de négociation s'est avérée aussi
difficile et n'a pas eu davantage de succès. Rappelons que Eckstein et Wilson
avaient réussi à déterminer un cycle de négociation aux États-Unis en se fon-
dant sur les données de Levinson partant sur les négociations concluses.
Cependant, l'interprétation qu'ils ont faite des données de Levinson a été
mise en doute. Nous avons utilisé une technique semblable dans l'espoir de
déceler l'existence d'un cycle de négociation dans les données canadiennes
portant sur les négociations collectives, sans succès cependant. Une telle
conclusion est conforme à celles auxquelles était déjà arrivé le Conseil
économique du Canada.

En l'absence de toute autre indication, nous avons choisi d'utiliser
les dates exactes qui correspondent au cycle de négociation, tel que défini
par Eckstein et Wilson. Nous avons donc introduit dans l'équation (5) des
variables fictives pour représenter chaque cycle complet, et procédé de nou-
veau à l'estimation de l'équation pour quelques industries, dans le but de

déterminer la signification statistique de la valeur estimative des coeffi-
cients accompagnant chaque variable fictive. Si la valeur estimative de ces
coefficients s'était avérée statistiquement significative, l'on aurait pu
conclure, soit à l'existence au Canada d'un cycle de négociation semblable
à celui qui existe aux Etats-Unis, soit à l'influence qu'exerce sur les
salaires canadiens le cycle de négociation des secteurs-clef dans l'indus-
trie américaine. Malheureusement, il en va tout autrement: isolément, la
valeur estimative de la plupart des coefficients s'est avérée non significa-
tive; considérés ensemble, les coefficients ne furent significatifs dans
aucun cas.

Avant de décrire les tests que nous avons fait subir à la troisième
définition d'un secteur-clef, il convient de décrire un autre test que nous
avons utilisé pour les deux premières définitions, fondé sur l'estimation
de l'équation suivante dans chaque industrie:

$$W_i^* = a + b \, (X_i)$$

où $W^*_i = 100 \, (W_t - W_{t-4}) / W_{t-4}$, et X_i peut être alternativement défini
de trois façons:

(i) $W^*_T = \sum\limits_{j=0} \dot{W}_{T_{t-j}}$

où $W_T = 100 \, (W_{T_t} - W_{T_{t-4}}) / W_{T_{t-4}}$;

(ii) en remplaçant W_T par W_I en (i) ci-haut, où W_I est une moyenne
non pondérée du salaire horaire moyen dans les industries inclu-
ses dans le secteur-clef I;

(iii) en remplaçant W_T par W_{II} en (i) ci-haut, où W_{II} est une moyenne
non pondérée du salaire horaire moyen dans les industries inclu-
ses dans le secteur-clef II.

Nous avons ensuite appliqué le "student - t" à la valeur estimative du coefficient b dans chaque industrie, dans le but de déterminer si les changements procentuels de salaires dans chaque industrie étaient plus étroitement associés aux changements de salaire dans les groupes-clef, selon l'une ou l'autre des deux définitions, qu'aux changements de salaire dans tout le secteur manufacturier. Ce test, bien que non définitivement concluant, indique qu'il n'existe aucune raison de croire que les changements de salaire dans chaque industrie sont plus étroitement associés aux changements de salaire dans les secteurs-clef qu'aux changements de salaires dans le secteur manufacturier tout entier.

Le troisième secteur-clef a été défini plus haut en fonction des employés couverts par les conventions collectives. Dans le but de déterminer l'influence des changements de salaire dans ce secteur-clef sur les changements de salaire dans chaque industrie, nous avons procédé de nouveau à l'estimation de l'équation (5), après y avoir inclus une nouvelle variable:

$$CB^* = \frac{1}{4} \sum_{j=0}^{3} CB_{t-j}$$

où CB_t est l'augmentation annuelle moyenne, en pourcentage, des taux de salaire de base pour la durée decchaque convention collective pour toutes les unités de négociation incluses dans l'échantillon complété au cours du trimestre t. En plus d'un décalage échelonné, nous avons également ajouté un décalage fixe de deux trimestres en introduisant CB* dans l'équation sous la forme $(CB^*)_{t-2}$, afin de consentir aux secteurs autre que les secteurs-clef un délai de réaction plus long, face aux changements de salaire qui surviennent dans les secteurs-clef. Les résultats sont présentés au Tableau IV-9.

En se basant sur les estimations de $\bar{R}^2$ et sur d'autres critères, l'on

peut conclure que, à quelques exceptions près, les estimations présentées

au Tableau IV-10 sont légèrement supérieures aux estimations présentées dans

le Tableau III-4. Fait intéressant à noter, les changements dans la varia-

ble $(CB^*)_{t-2}$ semblent très étroitement liés aux changements de salaire ΔW_i

dans sept industries; la liaison n'est faible que dans un seul cas. De

plus, l'inclusion de $(CB^*)_{t-2}$ réduit sensiblement la signification statisti-

que de plusieurs autres variables explicatives, notamment U^{*-2} , qui ne

demeure statistiquement important que dans le cas de quatre industries, et

$(W_i/W_T)_{t-4}$, où la réduction est cependant moins notable. Par ailleurs,

l'inclusion de $(CB^*)_{t-2}$ ne semble aucunement influer sur la demande de main-

d'oeuvre et les profits par unité de production. Enfin, la variable W_i/W_{us_i}

ne demeure importante que dans le cas d'une seule industrie: les appareils

électriques.

Cependant, ces résultats sont moins significatifs qu'on ne serait porté

à le croire à première vue, étant donné l'étroite interaction entre $(CB^*)_{t-2}$,

U^{*-2} et $(W_i/W_T)_{t-4}$. D'abord, comme une partie du changement que subit

$(CB^*)_{t-2}$ est également inclus dans ΔW_i , ces deux variables risquent fort

d'évoluer de façon semblable. Ensuite, comme U^{*-2} perd une partie de son

pouvoir explicatif dès lors que $(CB^*)_{t-2}$ est inclus dans la relation, l'on

peut supposer que c'est en regard du niveau de chômage que les syndicats

utilisent le plus fréquemment leur pouvoir de monopole. De plus, l'on pour-

rait supposer que l'action directe des syndicats sur l'offre de main-d'oeuvre

dans une industrie donnée varie en raison inverse du niveau de chômage dans

l'économie. Ainsi, bien que les résultats présentés au Tableau IV-10 confir-

ment le rôle avant-gardiste que les unités de négociation incluses dans

l'échantillon semblent avoir joué dans le processus de détermination des

salaires, il n'en reste pas moins que les changements de salaire dans ce
secteur-clef sont très fortement influencées par les conditions qui existent
sur le marché du travail. Nous en arrivons donc à souligner ce qui consti-
tue la faille principale de l'hypothèse portant sur les effets de débordement
originant des secteurs-clef, c'est-à-dire l'absence d'une théorie pouvant
servir de base à une analyse empirique visant à déterminer la validité de
cette hypothèse, relativement à d'autres explications possibles des change-
ments de salaire.

4. Conclusions

Le but principal de la présente étude consistait à identifier les fac-
teurs qui déterminent les changements du taux nominal de salaire dans l'in-
dustrie manufacturière canadienne. Bien que les résultats obtenus soient
quelque peu sujet à caution, ils sont néanmoins conforme à la notion que,
dans la plupart des industries, les changements de salaire sont étroitement
associés aux variations des salaires relatifs (c'est-à-dire aux variations
du salaire dans une industrie relativement au salaire moyen dans l'économie)
et du niveau de chômage. Dans plusieurs industries, la demande de main-
d'oeuvre joue également un rôle important. Les facteurs les moins importants
sont les profits par unité de production et le niveau des salaires relative-
ment à l'industrie correspondante aux Etats-Unis.

Nos conclusions sont conformes à celles que l'on trouve dans plusieurs
études qui ont porté sur le même problème, mais à un niveau d'agrégation plus
élevé, au Canada et ailleurs. De plus, nos conclusions soulignent l'influence
des conditions économiques générales sur les changements de salaire dans
certaines industries, indépendamment des autres influences particulières à
chaque industrie. Bien que les conditions économiques influent sur toutes

les variables retenues dans la présente étude, leur action s'exerce plus
directement sur le niveau de chômage et celui des salaires. Dans plusieurs
industries, cette action semble être conditionnée par les changements de la
demande de main-d'oeuvre.

Pour peu qu'on le sache, les grèves ne semblent pas liées d'une façon
systématique au taux de changement des salaires négociés collectivement.
De plus, la présence des syndicats dans l'industrie ne semble pas liée de
façon significative au taux de changement des salaires dans l'industrie
canadienne de 1961 à 1966; il en va de même en regard des profits par unité
de production et des salaires dans l'industrie américaine.

Nos résultats ne confirment pas l'hypothèse des secteurs-clef. D'abord
l'existence même des secteurs-clef et d'un cycle de négociation peut être
mise en doute. De plus, même lorsque les changements de salaire dans une
industrie donnée semblent défendre des changements qui se sont produits anté-
rieurement dans un secteur-clef préalablement défini, l'on peut quand même
se demander si la liaison entre ces derniers et les changements dans tout le
secteur manufacturier ne serait pas plus étroite.

Quoi qu'il en soit, l'hypothèse des secteurs-clef mérite sans doute
d'être retenue, à la condition que l'on définisse le secteur-clef par rapport
aux employés couverts par les conventions collectives, plutôt qu'en fonction
d'industries particulières. Nos résultats confirment que, au niveau de
l'économie toute entière, les changements de salaire résultant de négocia-
tions collectives sont liés positivement aux changements de salaire dans
plusieurs industries particulières. Cependant, étant donné l'étroite inter-
action qui existe entre les changements de salaire résultant de négociations
collectives au niveau de l'économie et les conditions qui caractérisent le

marché du travail, il s'est avéré impossible de vérifier l'existence des effets de débordement que ces deux facteurs exercent respectivement sur les changements de salaire dans chaque industrie.